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MODERATE SPECTRAL ATMOSPHERIC RADIANCE AND TRANSMITTANCE CODE (MOSART).

Volume IV: Software Reference Manual

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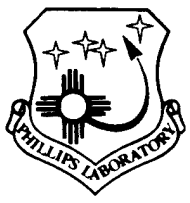

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"This technical report has been reviewed and is approved for publication"

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13. ABSTRACT *(Maximum 200 words)*

The Moderate Spectral Atmospheric Radiance and Transfer (MOSART) computer program calculates atmospheric transmission and radiation in the ultraviolet region through the microwave spectral regions (0.2 μm to infinity or 0 - 50,000 cm^{-1}. The spectral resolution is variable from a value of 2 cm^{-1} upward in increments of 1 cm^{-1}. It contains features which have been extracted from the MODTRAN code developed by the Geophysics Division (PL/GPOS) of the Air Force Phillips Laboratory and the APART code developed by Photon Research Associates (PRA). Because of the requirement that MOSART be compatible with various codes used in the SSGM (Strategic Scene Generation Model), the overall structure of this version of MOSART closely follows that of APART. However, MOSART contains all the MODTRAN atmospheric features and is easily used for that code's usual point-to-point calculations.

This volume provides the user with information describing the installation of MOSART. The other volumes describe running the code (Vol. II), technical discussion (Vol. III), and the structure of MOSART (Vol. IV). To provide users with on-line assistance, this volume is available in a series of "html" files that can be viewed using the MOSART Input Builder or the MOSAIC Software.

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1.0 INTRODUCTION

The Moderate Spectral Atmospheric Radiance and Transfer (MOSART) computer program calculates atmospheric transmission and radiation in the ultraviolet through the microwave spectral regions (0.2 μm to infinity or 0 - 50,000 cm^{-1}). The spectral resolution is variable from a value of 2 cm^{-1} upward in increments of 1 cm^{-1}. It contains features which have been extracted from the MODTRAN code developed by the Geophysics Division (PL/GPOS) of the Air Force Phillips Laboratory and the APART code developed by Photon Research Associates (PRA). MODTRAN is widely used in many different atmospheric studies, both within and without the DoD. Since APART was developed to provide atmospheric calculations for infrared (IR) signature studies of both targets and backgrounds, it has many features that are desirable for large simulation models. Because of the requirement that MOSART be compatible with various codes used in the SSGM (Strategic Scene Generation Model), the overall structure of this version of MOSART closely follows that of APART. However, MOSART contains all the MODTRAN atmospheric features and is easily used for that code's usual point-to-point calculations.

This volume of the Users Manual provides the user with the information on the structure of the code. The other volumes in the Users Manual describe installation of MOSART (Vol. I), executing the code (Vol. II), and technical discussion (Vol. III).

MOSART and its utility programs are written in ANSI X3.9-1978 FORTRAN (FORTRAN 77) and are very portable programs. The source code delivered with MOSART includes:

FPTEST:	Test machine dependent operations
INSTDB:	Installs direct access binary data bases
MOSART:	Is the main MOSART program
PLTGEN:	Makes graphs of the results
ASCBIN:	Converts binary files to ASCII and vice-versa
CRFILE:	Assists in preparing the MOSART input file
MRFLTR:	Degrades the spectral output using a filter function
BBTEMP:	Converts radiance to equivalent blackbody temperatures
VISUAL:	Converts visible radiances to luminances and determines color
SGNGEN:	Creates statistical scenes
FACET:	Calculates the signature of simple geometric shapes
TERTEM:	Calculates terrain material temperatures

2.0 DATA FLOW AND SYSTEM STRUCTURE

The overview of the MOSART system architecture and the basic data flow are discussed below.

2.1 Software Architecture Overview

Version 1.40 of the MOSART code consists of 96,847 lines of code. It is comprised of a main program, 154 subroutines, 86 real functions, 9 double precision functions, 1 logical function, 6 complex functions, 13 integer functions, 3 character functions, and 59 BLOCK DATA modules. It also accesses up to 14 direct access binary data files and utilizes up to 2 scratch files. An architecture diagram is shown in Figure 1.

The MOSART code is supported by several codes. These are:

- ASCBIN provides ASCII-binary conversion and creates spectral tables. It consists of the 4,733 lines of code. It is comprised of a main program, 16 subroutines, 7 real functions, 2 integer functions, 4 double precision functions, 3 character functions, and 3 BLOCK DATA modules.

- BBTEMP converts radiance to equivalent blackbody temperatures. It consists of 7,207 lines of code. It is comprised of a main program, 14 subroutines, 9 real functions, 4 double precision functions, 2 integer functions, 3 character functions, and 5 BLOCK DATA modules.

- CRFILE creates the various input files. It consists of 9,170 lines of code. It is comprised of a main program, 34 subroutines, 13 real functions, 3 character functions, 3 integer functions, 1 double precision function, and 9 BLOCK DATA modules.

- FACET calculates the signature of simple geometric objects. It consists of 8,551 lines of code. It is comprised of a main program, 17 subroutines, 14 real functions, 6 double precision functions, 3 character functions, 2 integer functions, 2 complex functions, and 5 BLOCK DATA modules.

- FPTEST tests various machine-dependent parameters prior to installation of the other codes. It consists of 2,614 lines of code. It is comprised of a main program, 5 subroutines, 5 real functions, 4 double precision functions, 1 logical function, 1 integer function, 1 character function, and 1 BLOCK DATA module.

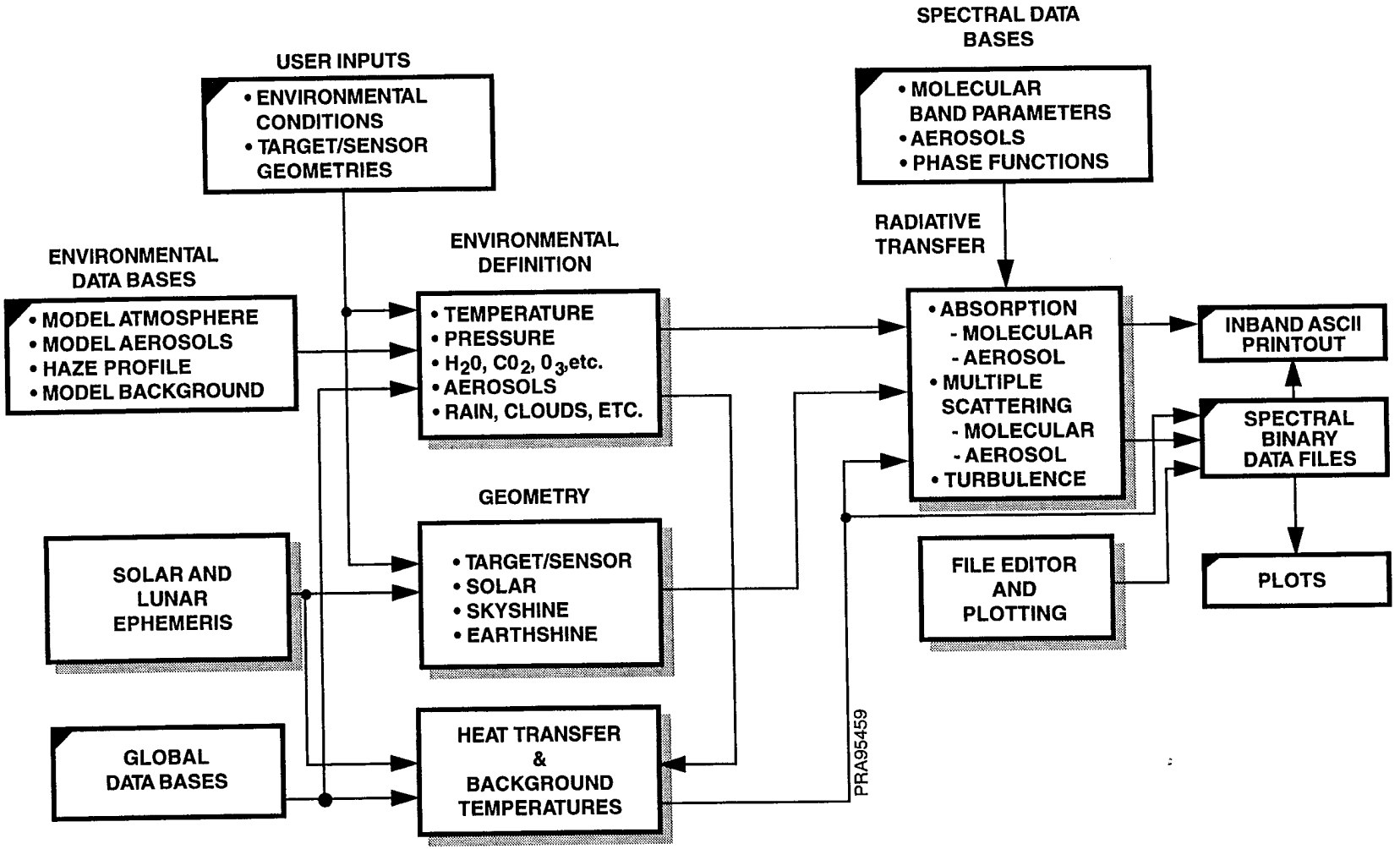


Figure 1. MOSART Architecture.

- INSTD installs the direct access binary data bases. It consists of 2,709 lines of code. It is comprised of a main program, 5 subroutines, 1 integer function, 2 character functions, and 3 BLOCK DATA modules.

- MRFLTR spectrally integrates a MOSART binary output file over a different spectral interval or with a different filter function. It consists of 27,865 lines of code. It is comprised of a main program, 63 subroutines, 15 real functions 4 double precision functions, 11 integer functions, 3 character functions, and 14 BLOCK DATA modules.

- PLTGEN provides spectral plots using the NCAR plotting software package. It consists of 2,342 lines of code. It is comprised of a main program, 8 subroutines, 3 character functions, 1 integer function, and 2 BLOCK DATA modules.

- SCNGEN creates statistical two-dimensional scenes. It consists of 3,625 lines of code. It is comprised of a main program, 12 subroutines, 12 real functions, 4 double precision functions, 3 integer functions, and 3 character functions.

- TERTEM calculates terrain material temperatures. It consists of 10,853 lines of code. It is comprised of a main program, 16 subroutines, 20 real functions, 4 double precision functions, 4 integer functions, 3 character functions, and 8 BLOCK DATA modules.

- VISUAL converts radiance to luminance in the visible spectral region. It consists of 6,834 lines of code. It is comprised of a main program, 16 subroutines, 5 real functions, 4 double precision functions, 2 integer functions, 1 character function, and 4 BLOCK DATA modules.

2.2 Data Flow

The basic data flow is presented in Figure 2.

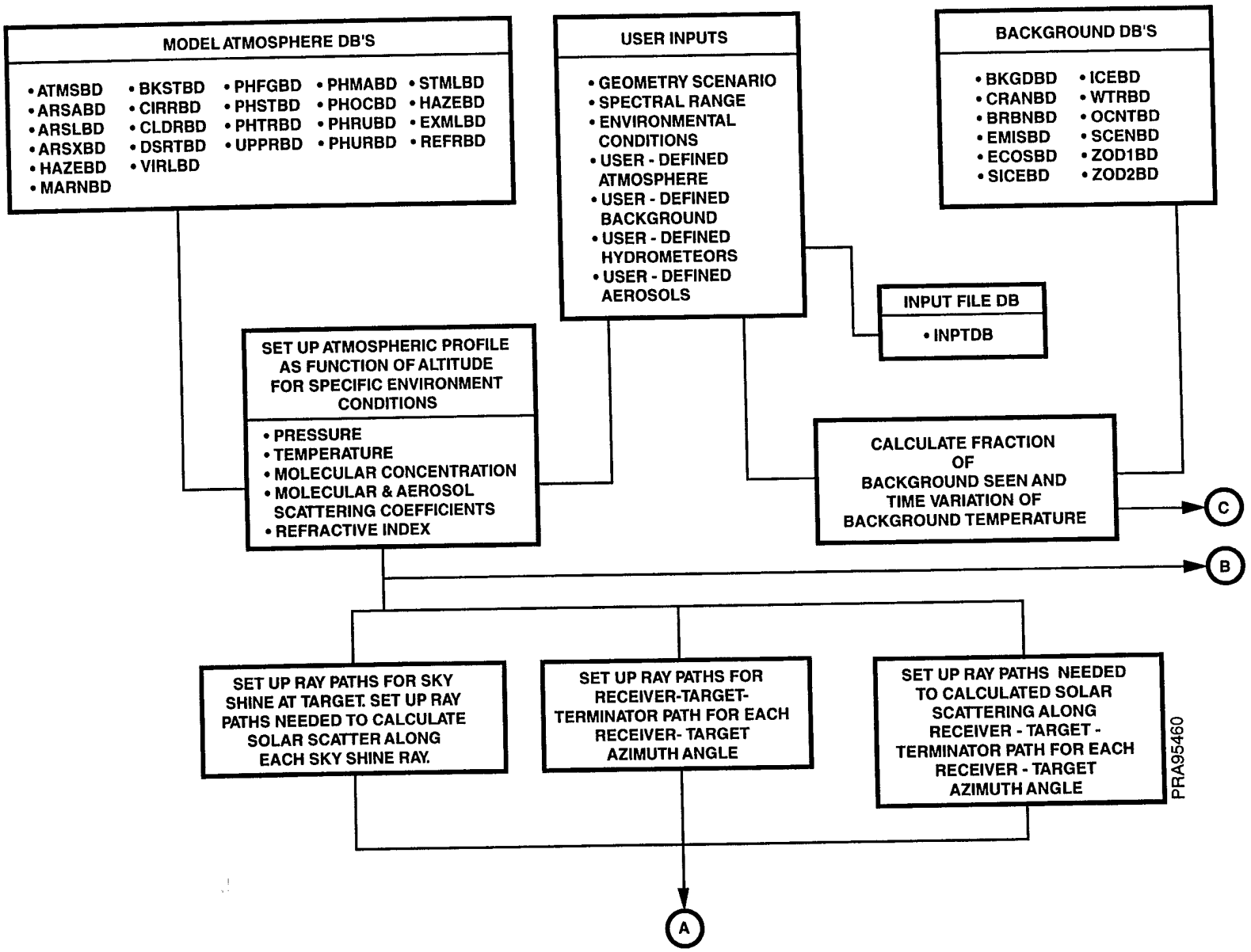


Figure 2. Basic Data Flow.

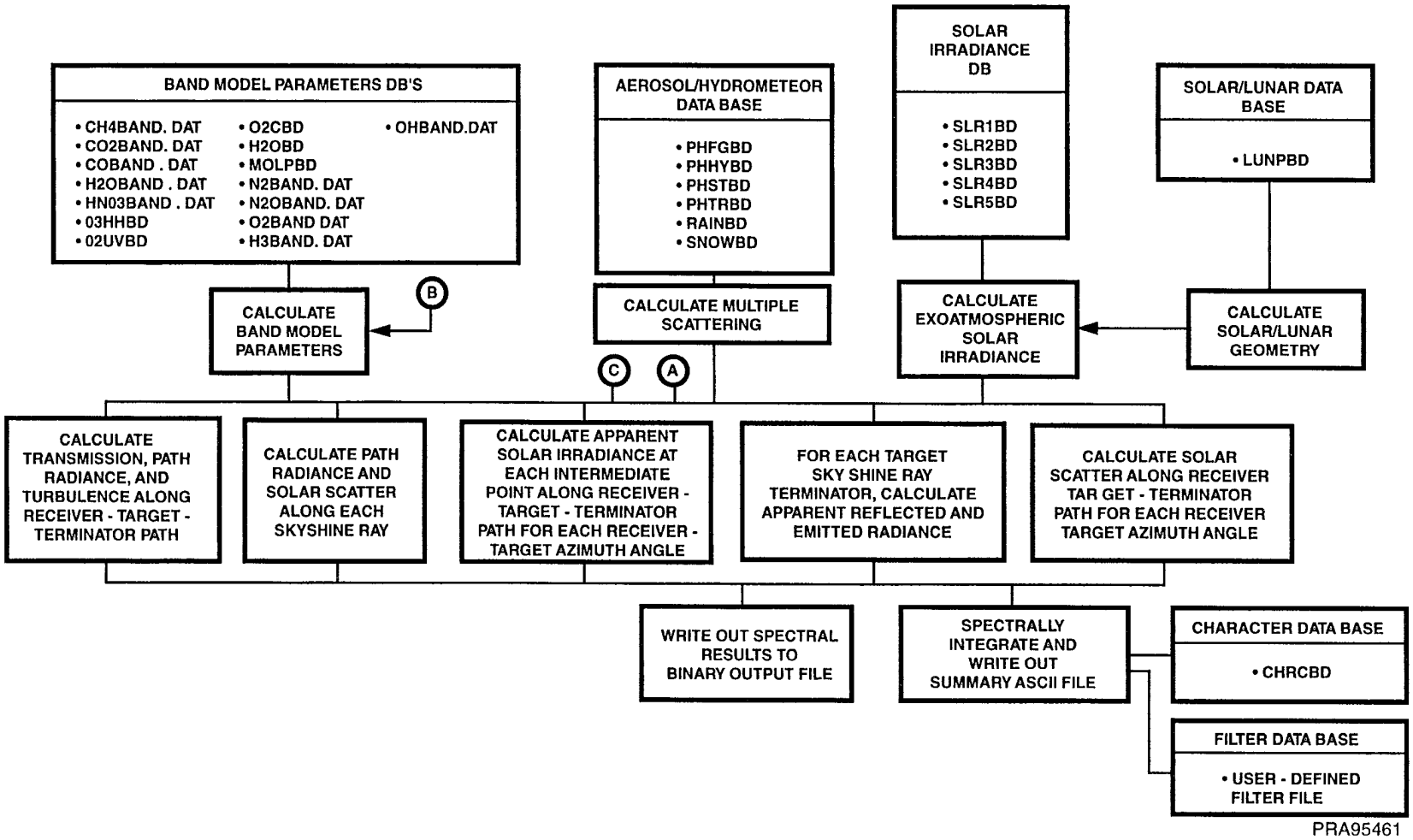


Figure 2. Basic Data Flow (continued).

3.0 MODULE STRUCTURE DESCRIPTION

The module structure descriptions for the MOSART program and related utility codes are presented below.

3.1 MOSART

The subroutines and functions contained in the MOSART program are listed below in alphabetical order. In addition to a brief description of each routine, the Creation Date and Revision Data for each routine is provided.

REAL FUNCTION ABCCL4
Created on: Wed May 25 15:44:44 1994
Revised on: Mon Nov 7 14:33:47 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for CCl4.

REAL FUNCTION ABHNO4
Created on: Wed May 25 15:44:44 1994
Revised on: Mon Nov 7 14:33:47 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for HNO4.

REAL FUNCTION ABN2O5
Created on: Wed May 25 15:44:44 1994
Revised on: Mon Nov 7 14:33:47 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for N2O5.

REAL FUNCTION ABSCFC
Created on: Wed May 25 15:44:44 1994
Revised on: Mon Nov 7 14:33:48 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for the chloro-fluorocarbons.

REAL FUNCTION ABSCLO
Created on: Wed May 25 15:44:44 1994
Revised on: Mon Nov 7 14:33:47 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for CCl4.

REAL FUNCTION ABSH2O
Created on: Wed Nov 18 15:40:09 1992
Revised on: Tue Mar 1 07:55:51 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the water vapor absorption coefficient.

SUBROUTINE ABSMOL
Created on: Wed Nov 18 15:40:13 1992
Revised on: Tue Nov 22 09:07:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the molecular absorption coefficients.

REAL FUNCTION ABSN2
Created on: Wed Nov 18 15:40:19 1992
Revised on: Tue Mar 1 07:55:53 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the LOWTRAN nitrogen continuum.

REAL FUNCTION ABSN2O
Created on: Wed Nov 18 15:40:22 1992
Revised on: Thu Feb 11 15:22:53 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the nitrogen oxide absorption coefficient.

REAL FUNCTION ABSNO2
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:17 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for NO2.

SUBROUTINE ABSO2
Created on: Wed Nov 18 15:40:32 1992
Revised on: Mon Aug 2 11:07:08 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the Herzberg and Schumann-Runge O2 absorption coefficient.

REAL FUNCTION ABSO3
Created on: Wed Nov 18 15:40:35 1992
Revised on: Wed Jun 15 14:01:02 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the Hartley Huggins and Chappuis/Wulf O3 absorption coefficient.

REAL FUNCTION ABSSO2
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:17 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the cross-section for SO2.

SUBROUTINE AECALC
Created on: Wed Nov 18 15:58:19 1992
Revised on: Tue May 9 10:03:08 1995
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the solar absorptivity and thermal emissivity from a reflectivity curve.

SUBROUTINE AERSOL
Created on: Wed Nov 18 15:40:40 1992
Revised on: Wed Oct 26 11:04:56 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the absorption and scattering coefficients for the aerosol, normalized to unity for extinction at a wavelength of 0.55 μm.

REAL FUNCTION AH2O2
Created on: Wed Nov 18 15:40:46 1992
Revised on: Tue May 4 09:19:42 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the absorption coefficient for a combination of hydrogen and deuterium peroxide.

REAL FUNCTION AIRTMP
Created on: Wed Nov 18 15:40:54 1992
Revised on: Mon May 17 17:33:13 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the local surface air temperature (K) at a particular time of day. If the user has supplied a reference temperature for a given time, temperatures for other times are calculated as differences from the user-supplied temperature.

SUBROUTINE AMMNIA
Created by: Dr. William M. Cornette
Created on: 14 October 1993
Revised on: Tue Nov 2 10:42:56 1993

This SUBROUTINE determines the band model parameters for ammonia between 3050 and 3600 wavenumbers.

REAL FUNCTION AMOLSC
Created on: Wed Nov 18 16:05:47 1992
Revised on: Thu Jun 23 12:43:46 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the scattering coefficient due to molecular scattering.

Reference: Cornette, "Suggested modification to the total volume molecular scattering coefficient in LOWTRAN," Applied Optics, Vol. 19 (1980), pp A182-3.

SUBROUTINE ASPECT
Created on: Wed Nov 18 15:41:01 1992
Revised on: Mon Nov 7 14:34:11 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the skyshine angles.

SUBROUTINE ATMPRN
Created on: Wed Nov 18 15:41:08 1992
Revised on: Tue Nov 22 09:07:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the atmospheric parameters for the atmospheric sub-file.

DOUBLE PRECISION FUNCTION BAND
Created on: Wed Nov 18 15:41:17 1992
Revised on: Mon Nov 7 14:34:12 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the transmittance from the desired band model.

SUBROUTINE BBARSL
Created on: Tue May 4 09:14:26 1993
Revised on: Mon Nov 7 14:34:11 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the broadband (solar and thermal) coefficients for the aerosols.

REAL FUNCTION BBO3
Created on: Wed Nov 18 15:41:20 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the ozone absorption from Lacis & Hansen (1974).

SUBROUTINE BCKCHK
Created on: Wed Nov 18 15:41:24 1992
Revised on: Thu Jun 23 12:43:51 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines if the observer is looking into the sun or the moon.

SUBROUTINE BCKGND
Created on: Wed Nov 18 15:41:27 1992
Revised on: Tue Nov 22 09:07:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the background radiance.

SUBROUTINE BCKPRN
Created on: Wed Nov 18 15:41:32 1992
Revised on: Tue Nov 22 09:07:09 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the atmospheric parameters.

REAL FUNCTION BDRF
Created on: Wed Nov 18 15:41:37 1992
Revised on: Tue Nov 2 10:42:28 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the incoherent bidirectional reflectance function for a rough opaque surface.

SUBROUTINE BEAUFT
Created on: Wed Nov 18 15:41:40 1992
Revised on: Thu Jun 23 12:43:35 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates ocean parameters as a function of wind speed.

Reference: Smithsonian Table 36, Beaufort Wind Scale

REAL FUNCTION BETA
Created on: Wed Nov 18 15:41:43 1992
Revised on: Thu Jun 23 12:43:46 1994
Created by: Dr. William M. Cornette

This FUNCTION computes the average backscattered fraction. The current routine uses the Cornette-Shanks phase function. The parameters and algorithms for the Henyey-Greenstein phase function are commented out with 'CHG'.

REAL FUNCTION BETAU
Created on: Wed Nov 18 15:41:46 1992
Revised on: Fri Jul 1 15:08:49 1994
Created by: Dr. William M. Cornette

This FUNCTION computes the zenith angle dependent backscattered fraction. The routine currently uses the Cornette-Shanks phase function. The parameters and algorithms for the Henyey-Greenstein phase function are commented out with 'CHG'.

SUBROUTINE BINFIL
Created on: Wed Nov 18 15:41:53 1992
Revised on: Tue Nov 22 09:07:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE OPENs the binary output files.

SUBROUTINE BMOD
Created on: Wed Nov 18 15:41:55 1992
Revised on: Mon Nov 7 14:33:46 1994
Created by: Dr. William M. Cornette

This SUBROUTINE obtains the band parameters.

SUBROUTINE BNDMLG
Created on: Wed Nov 18 15:42:02 1992
Revised on: Mon Nov 7 14:33:45 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the multiple line group (MLG) partition function.

SUBROUTINE BNDPAR
Created on: Wed Nov 18 15:42:07 1992
Revised on: Tue Nov 22 09:07:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the band parameters for all of the molecular types, molecular scattering, aerosol extinction, hydrometeors (clouds, fog and rain), and cirrus clouds.

SUBROUTINE BNTPTH
Created on: Wed Nov 18 15:42:12 1992
Revised on: Wed Jun 15 14:01:00 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the summing variables for the second leg of a path. The final variables for the first leg are used as the starting points for the second leg.

SUBROUTINE BRBNDR
Created on: Wed Nov 18 15:42:16 1992
Revised on: Tue Nov 22 09:07:09 1994
Created by: Dr. William M. Cornette

This SUBROUTINE directs the processing sequence for all "Broad-band" submodules.

SUBROUTINE CALCUL
Created on: Wed Nov 18 15:42:32 1992
Revised on: Tue Nov 22 09:07:01 1994
Created by: Dr. William M. Cornette

This SUBROUTINE is the driver for calculating the MOSART binary files.

SUBROUTINE CALEND
Created on: Wed Nov 18 15:42:35 1992
Revised on: Mon Apr 25 08:34:57 1994
Created by: Dr. William M. Cornette

This SUBROUTINE changes a day/month/year date to the day of the year and the decimal year, or day of the year to day/month/year and decimal year.

SUBROUTINE CHANGE
Created on: Wed Nov 18 15:58:51 1992
Revised on: Mon Apr 25 08:34:57 1994
Created by: Dr. William M. Cornette

This SUBROUTINE modifies a standard molecular concentration profile for temporal variations.

SUBROUTINE CHKRST
Created on: Wed Nov 18 15:42:38 1992
Revised on: Tue Apr 5 17:30:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines if a restart is required and if so, where it should start.

SUBROUTINE CHKVER
Created on: Wed Nov 18 15:42:41 1992
Revised on: Tue Nov 2 10:43:18 1993
Created by: Dr. William M. Cornette

Since VAX computer save different versions of the binary files, this SUBROUTINE checks to insure that the ones OPENed for summary were created at the same time. This is accomplished by comparing the heading and the title. If the file does not correspond to the source file, then it is CLOSEd.

SUBROUTINE CHTIME
Created on: Wed Nov 18 15:42:44 1992
Created by: Dr. William M. Cornette

This SUBROUTINE converts decimal time to hours, minutes, and seconds, and vice-versa.

REAL FUNCTION CIREX
Created on: Wed Nov 18 15:42:55 1992
Revised on: Thu Jun 23 12:43:34 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the extinction coefficient for a cirrus cloud.

SUBROUTINE CIRRUS
Created on: Wed Nov 18 15:42:58 1992
Revised on: Thu Jun 23 12:43:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE defines the default parameters for the cirrus cloud models.

SUBROUTINE CITIES
Created on: 13 October 1994
Revised on: Wed Apr 26 17:06:26 1995
Created by: Dr. William M. Cornette

This SUBROUTINE determines if a given latitude/longitude is located with a specific set of urban areas.

SUBROUTINE CLDALT
Created on: Wed Nov 18 15:43:02 1992
Revised on: Thu Jun 23 12:42:56 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the cloud altitudes for the low, middle, and high etage cloud layers.

SUBROUTINE CLDLYR
Created on: Wed Nov 18 15:43:11 1992
Revised on: Tue May 4 09:18:15 1993
Created by: Dr. William M. Cornette

This SUBROUTINE computes the optical properties for cloud layers; i.e., scattering optical depth and backscattering fraction.

SUBROUTINE CNSTNT
Created on: Wed Nov 18 15:43:15 1992
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the constants for the program. Some of these are provided in the commented out INTRINSIC and EXTERNAL Declarations. If your computer uses one not listed, please contact Dr. William M. Cornette.

Certain routines are available for determining appropriate numerical constants. These should be used if available.

REAL FUNCTION ADD

The following eight (8) functions are used by CNSTNT to force the storage of numbers into their standard format. Some computers (e.g., IBM PC Lahey) use a greater precision for internal register manipulation.

Created on: 15 February 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the addition of two REAL variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

REAL FUNCTION SUB
Created on: 15 February 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the subtraction of two REAL variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

REAL FUNCTION MUL
Created on: 23 August 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the multiplication of two REAL variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

REAL FUNCTION DIV
Created on: 23 August 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the division of two REAL variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

DOUBLE PRECISION FUNCTION DADD
Created on: 15 February 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the addition of two DOUBLE PRECISION variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

DOUBLE PRECISION FUNCTION DSUB
Created on: 15 February 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the subtraction of two DOUBLE PRECISION variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

DOUBLE PRECISION FUNCTION DMUL
Created on: 23 August 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the multiplication of two DOUBLE PRECISION variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

DOUBLE PRECISION FUNCTION DDIV
Created on: 23 August 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION performs the division of two DOUBLE PRECISION variables to work around the way some computers perform certain calculations in their registers with greater accuracy than they store.

INTEGER FUNCTION IBITS
Created on: 11 February 1993
Revised on: Thu Jun 23 12:43:31 1994
Created by: Dr. William M. Cornette

This FUNCTION duplicates the MIL-STD-1753 INTRINSIC FUNCTION IBITS using the MIL-STD-1753 INTRINSIC FUNCTIONs IBSET, IBCLR, and BTEST. IBM VS FUNCTIONs include the latter three, but not the FUNCTION IBITS.

SUBROUTINE COAT
Created on: Wed Nov 18 15:43:18 1992
Revised on: Tue Nov 2 10:42:53 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates absorption and scattering efficiencies for a coated sphere. For given radii and refractive indices of inner and outer spheres, refractive index of surrounding medium, and free space wavelength, COAT calculates size parameters and relative refractive indices.

REAL FUNCTION COMFNC
Created on: Wed Nov 18 15:43:22 1992
Revised on: Mon May 17 17:33:30 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the optical depth terms for the plume data file.

SUBROUTINE CONFIG
Created on: Wed Nov 18 15:43:28 1992
Revised on: Mon Aug 2 11:06:42 1993
Created by: Dr. William M. Cornette

This SUBROUTINE provides a method for system level setting of the configuration of the computer environment.

INTEGER FUNCTION ERROR_HANDLER
Created on: 3 December 1992
Revised on: Mon Aug 2 11:06:42 1993
Created by: Dr. William M. Cornette

This FUNCTION handles floating point error conditions. It presently STOPs execution if a floating point error occurs.

SUBROUTINE COUPLE
Created on: Wed Nov 18 15:43:31 1992
Revised on: Mon Nov 7 14:33:43 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the multiple scattering components.

COMPLEX FUNCTION CPF12
Created on: Wed Nov 18 15:43:35 1992
Revised on: Tue Mar 1 07:55:48 1994
Created by: Dr. William M. Cornette

This FUNCTION computes the real (WR) and imaginary (WI) parts of the complex probability function $w(z)=\exp(-z^2)*\mathrm{erfc}(-i*z)$ in the upper half-plane $z=x+i*y$ (i.e., for y.GE.0.0). Maximum relative error of WR.LT.2.0E-06, that of WI.LT.5.0E-06. This routine developed by J. Humlicek, JQSRT, Vol 21, p. 309 (1980).

REAL FUNCTION CSPHFN
Created on: Wed Nov 18 15:43:39 1992
Revised on: Thu Jun 23 12:43:33 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the Cornette-Shanks phase function. The Henyey-Greenstein function is commented out with 'CHG'.

REAL FUNCTION DBANDS
Created on: Wed Nov 18 15:43:59 1992
Revised on: Thu Jun 23 12:43:39 1994
Created by: Dr. William M. Cornette

This FUNCTION maps the surface brightness of a simple zodiacal dust band model for a set of ecliptic coordinates. Contributions from three band pairs, nominally corresponding to the three principal band pairs observed by IRAS, are added along the line-of-sight. Output is in $W/cm^2/sr/cm^{-1}$.

SUBROUTINE DBINIT
Created on: Wed Nov 18 15:44:05 1992
Revised on: Tue Nov 22 09:07:04 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the arrays used with respect to the data bases.

REAL FUNCTION DDIF
Created on: Wed Nov 18 15:44:23 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the three layer composite downward diffuse flux from solar beam given individual layer downward diffuse from solar fluxes and two-stream reflection and transmission functions.

SUBROUTINE DEFALT
Created on: Wed Nov 18 15:44:19 1992
Revised on: Tue Nov 22 09:07:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE sets the default values for the undefined input parameters.

SUBROUTINE DEFBCK
Created on: Wed Nov 18 15:44:29 1992
Revised on: Tue Nov 22 09:07:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE defines the background parameters for the observer-source-background geometry scenario.

SUBROUTINE DEMSXX
Created on: Wed Nov 18 15:45:03 1992
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the emissivities EMV and EMH as a function of angle for a series of dielectric layers.

REAL FUNCTION DENAIR
Created on: Wed Nov 18 15:44:33 1992
Revised on: Tue May 2 16:38:11 1995
Created by: Dr. William M. Cornette

This FUNCTION calculates the density (g/m^3) of moist air.

REAL FUNCTION DENWTR
Created on: Wed Nov 18 15:44:42 1992
Revised on: Mon May 17 16:41:39 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the density of water as a function of temperature (gm/m^3).

REAL FUNCTION DEPOL
Created on: Fri May 26 14:38:54 1995
Revised on: Tue May 30 12:58:08 1995
Created by: Dr. William M. Cornette

This FUNCTION calculates the molecular depolarization parameter.

Reference: D.R. Bates, "Rayleigh scattering by air," Planet. Space Sci. 32, 785-790 (1984).

DOUBLE PRECISION FUNCTION DERF
Created on: Wed Nov 18 15:44:44 1992
Revised on: Fri Sep 24 13:52:46 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the error function by rational approximation. The error is less than 1.5D-07.

SUBROUTINE DESAER
Created on: Wed Nov 18 15:44:51 1992
Revised on: Mon May 17 17:33:32 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the attenuation coefficients and asymmetry parameter for the Desert aerosol based on the wind speed.

SUBROUTINE DFLT2
Created on: Wed Nov 18 15:44:54 1992
Revised on: Thu Jun 23 12:43:55 1994
Created by: Dr. William M. Cornette

This SUBROUTINE established the defaults for the model atmosphere, haze profile, aerosol types, and related parameters.

SUBROUTINE DFLT8
Created on: Wed Nov 18 15:44:56 1992
Revised on: Tue Nov 22 09:07:09 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the default conditions for the spectral inputs.

COMPLEX FUNCTION DIREFL
Created on: Wed Nov 18 15:45:00 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the Fresnel coefficients of a dielectric surface.

SUBROUTINE DIREMS
Created on: Wed Nov 18 15:45:03 1992
Revised on: Mon Nov 7 14:34:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the emissivities EMV and EMH as a function of angle for a series of dielectric layers.

SUBROUTINE DISEND
Created on: Wed Nov 23 15:44:44 1994
Revised on: Wed Nov 23 13:38:09 1994
Created by: Dr. William M. Cornette; Dr. Prabhat K. Acharya

This SUBROUTINE positions the pointer to the end of the DIS file.

SUBROUTINE DISPRN
Created on: Wed Nov 23 15:44:44 1994
Revised on: Mon Nov 28 10:08:07 1994
Created by: Dr. William M. Cornette; Dr. Prabhat K. Acharya

This SUBROUTINE write the records to the DIS file.

REAL FUNCTION DNDR
Created on: Wed Nov 18 15:45:05 1992
Revised on: Thu Jun 23 12:43:28 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the number of particles in a radius interval according to parameters of selected size distribution.

REAL FUNCTION DPLDT
Created on: Wed Nov 18 15:45:10 1992
Revised on: Tue Nov 2 10:42:50 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the partial derivative of the spectral blackbody curve (Planck function) ($W/cm^2/cm^{-1}/K$).

SUBROUTINE DRTLAY
Created on: Wed Nov 18 15:45:16 1992
Revised on: Tue Nov 22 09:07:01 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the two stream directional R and T values. Ref.: "The Two-Stream Approximation in Radiative Transfer: Including the Angle of the Incident Radiation" J.A. Coakley and P. Chylek, JAS 32 (1975) 409-418.

REAL FUNCTION DVINCR
Created on: Wed Nov 18 15:45:19 1992
Revised on: Mon Nov 7 14:34:08 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the wavenumber increment for a defined wavenumber value.

SUBROUTINE ECLGAL
Created on: Wed Nov 18 15:57:42 1992
Revised on: Mon May 17 17:33:00 1993
Created by: Dr. William M. Cornette

This SUBROUTINE transforms the ecliptic coordinates to galactic coordinates.

REAL FUNCTION EHBSL0
Created on: Wed Nov 18 15:57:53 1992
Revised on: Tue Nov 2 10:42:25 1993

This FUNCTION calculates for positive X, EXP(-X)*I0(X), where I0 is the hyperbolic (modified) Bessel function of the first kind and zeroth order.

REAL FUNCTION EMISSV
Created on: Wed Nov 18 15:57:57 1992
Revised on: Mon Nov 7 14:34:08 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the volumetric emissivity appropriate at the distance and wavelength of interest ($W/cm^2/sr/cm^{-1}$).

COMPLEX FUNCTION EMTREF
Created on: Wed Nov 18 15:58:01 1992
Revised on: Mon Aug 2 13:13:34 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the effective index of refraction for a mixture of two dielectric mediums.

SUBROUTINE ENDPT
Created on: Wed Nov 18 15:58:04 1992
Revised on: Tue Nov 22 09:07:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the end point of a ray, given the slant range or the earth center angle, the initial altitude, and the direction.

SUBROUTINE EPHEML
Created on: Wed Nov 18 15:58:07 1992
Revised on: Tue Mar 1 07:55:53 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the position of the moon in the sky and the phase of the moon. Indices are set if either a lunar or a solar eclipse is possible.

SUBROUTINE EPHEMS
Created on: Wed Nov 18 15:58:10 1992
Revised on: Mon Nov 7 14:34:07 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the solar and lunar positions.

DOUBLE PRECISION FUNCTION EPHTIM
Created on: Wed Jun 15 14:01:14 1994
Revised on: Tue Jun 28 08:00:22 1994
Created by: Dr. William M. Cornette

This FUNCTION converts from Universal Time to Ephemeris Time.

SUBROUTINE EQABS
Created on: Wed Nov 18 15:58:42 1992
Revised on: Tue Nov 22 09:07:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the equivalent absorber amounts.

SUBROUTINE EQUABS
Created on: Wed Nov 18 15:58:19 1992
Revised on: Tue Nov 22 09:07:09 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the equivalent absorber amounts.

SUBROUTINE EQUECL
Created on: Wed Nov 18 15:58:45 1992
Revised on: Mon May 17 17:33:06 1993
Created by: Dr. William M. Cornette

This SUBROUTINE transforms equatorial coordinates to ecliptical coordinates.

SUBROUTINE ESFIT
Created on: Wed Nov 18 15:58:51 1992
Revised on: Mon Nov 7 14:34:07 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the exponential sum fit for the transmittance function. The Malkmus band model is used to represent the transmittance function.

REAL FUNCTION EVAPOR
Created on: Wed Nov 18 15:58:59 1992
Revised on: Mon May 17 16:41:23 1993

This FUNCTION calculates the latent heat of evaporation for water.

LOGICAL FUNCTION EVEN
Created on: Wed Nov 18 15:59:02 1992
Created by: Dr. William M. Cornette

This FUNCTION determines if an INTEGER is even or not.

REAL FUNCTION EXGALS
Created on: Wed Nov 18 15:59:06 1992
Revised on: Mon May 17 16:41:27 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the extragalactic radiance ($W/cm^2/sr/cm^{-1}$).

SUBROUTINE EXOATM
Created on: Wed Nov 18 15:59:09 1992
Revised on: Tue May 24 13:18:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE loads the proper values of temperature and pressure in the arrays TUX and PUX, respectively for the upper atmosphere (i.e., above 100 km).

REAL FUNCTION EXOTMP
Created on: Mon Jul 23 11:16:11 1990
Revised on: Sun Nov 27 20:47:59 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the exoatmospheric temperature to be used to select the proper upper atmosphere profile.

SUBROUTINE FILOPN
Created on: Wed Nov 18 15:57:12 1992
Revised on: Tue Nov 22 09:07:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines if a user-specified file is to be OPENed or not. If not, the unit number is set to 0.

SUBROUTINE FILRT
Created on: Wed Nov 18 15:57:15 1992
Revised on: Tue Nov 22 09:07:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE uses a file root name to establish several filenames for input, ASCII output, and binary output.

REAL FUNCTION FILTER
Created on: Wed Nov 18 15:57:17 1992
Revised on: Thu Jun 23 12:43:44 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the filter response specified.

SUBROUTINE FLSTAT
Created on: Wed Nov 18 15:57:20 1992
Revised on: Tue Nov 22 09:07:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the status of the binary data files.

SUBROUTINE FLUXLW
Created on: Wed Nov 18 15:57:24 1992
Revised on: Tue Mar 1 07:55:52 1994
Created by: Dr. William M. Cornette

This SUBROUTINE computes the upward and downward diffuse fluxes in the terrestrial (longwave) band.

SUBROUTINE FRESNL
Created on: Wed Nov 18 15:57:31 1992
Revised on: Thu Jun 23 12:43:43 1994

This SUBROUTINE calculates the reflectivities and transmissivities for horizontally and vertically polarized electric fields.

REAL FUNCTION GALRAD
Created on: Wed Nov 18 15:54:51 1992
Revised on: Mon May 17 17:33:43 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the spectral mean space background due to diffuse galactic sources in $W/sr/cm^2/cm^{-1}$.

REAL FUNCTION GAM
Created on: Wed Nov 18 15:54:53 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the three layer composite multiple reflection factor, given the individual layer reflection and transmission functions.

REAL FUNCTION GAMMLN
Created on: Wed Nov 18 15:55:14 1992
Revised on: Thu Feb 11 15:26:05 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the natural logarithm of the gamma function for DX > 0.

SUBROUTINE GBLBCK
Created on: Wed Nov 18 15:55:55 1992
Revised on: Thu Jun 23 12:42:56 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the terrain scene and altitude as a function of latitude and longitude for the global data base.

SUBROUTINE GEOM
Created on: Wed Nov 18 15:55:58 1992
Revised on: Mon Nov 7 14:34:06 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the geometric parameters for a specified ray path through a spherically isotropic atmosphere.

SUBROUTINE GETASP
Created on: Wed Nov 18 15:56:05 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the earth/skyshine aspect parameters.

SUBROUTINE GETATM
Created on: Wed Nov 18 15:56:13 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the model atmosphere parameters.

SUBROUTINE GETBCK
Created on: Wed Nov 18 15:56:16 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the terrain and background parameters.

SUBROUTINE GETCLD
Created on: Wed Nov 18 15:56:23 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the hydrometeor (cloud, fog, rain, snow) parameters.

SUBROUTINE GETEXO
Created on: Wed Apr 3 10:28:25 1991
Revised on: Mon Nov 7 14:34:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the exoatmospheric parameters.

SUBROUTINE GETGLC
Created on: Wed Nov 18 15:56:31 1992
Revised on: Tue Mar 1 07:55:47 1994
Created by: Dr. William M. Cornette

This SUBROUTINE obtains the desired Gauss-Legendre coefficients.

SUBROUTINE GETPOS
Created on: Wed Nov 18 15:56:37 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the source position and time.

SUBROUTINE GETSLR
Created on: Wed Nov 18 15:56:40 1992
Revised on: Tue Nov 22 09:07:08 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the solar and lunar data.

REAL FUNCTION GETVAR
Created on: Wed Nov 18 15:56:43 1992
Revised on: Mon Apr 25 08:34:50 1994
Created by: Dr. William M. Cornette

This FUNCTION reads a REAL variable contained in free format in the CHARACTER string VARIAB.

SUBROUTINE GETVEC
Created on: Wed Nov 18 15:56:47 1992
Revised on: Thu Jun 23 12:43:24 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads a REAL vector contained in free format in the CHARACTER string VARIAB.

SUBROUTINE H2OCNT
Created on: Wed Nov 18 15:53:59 1992
Revised on: Tue Mar 1 07:55:36 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the LOWTRAN self- and foreign-broadened line wings absorption coefficients.

REAL FUNCTION HAZE
Created on: Wed Nov 18 15:54:02 1992
Revised on: Mon Nov 7 14:34:04 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the aerosol extinction coefficient (km^{-1}).

REAL FUNCTION HEYMS
Created on: Wed Nov 18 15:54:09 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the liquid water content (gm/m^3) for a cirrus cloud according to Heymsfield.

REAL FUNCTION HLOWT
Created on: Wed Nov 18 15:46:44 1992
Revised on: Mon Aug 2 13:14:27 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the boundary layer altitude based upon the LOWTRAN modification of the haze profile for elevated locations.

SUBROUTINE HOREQU
Created on: Wed Nov 18 15:54:24 1992
Revised on: Mon May 17 17:33:46 1993
Created by: Dr. William M. Cornette

This SUBROUTINE converts horizon coordinates to equatorial coordinates.

SUBROUTINE HORIZN
Created on: Wed Nov 18 15:54:28 1992
Revised on: Thu Jun 23 12:43:43 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the horizon and whether the desired geometry is beyond the horizon or not.

SUBROUTINE HTBLNC
Created on: Wed Nov 18 15:54:32 1992
Revised on: Thu Jun 23 12:43:23 1994
Created by: Dr. William M. Cornette

This SUBROUTINE is the layer temperature calculation algorithm.

SUBROUTINE HYDROM
Created on: Wed Nov 18 15:54:35 1992
Revised on: Mon Nov 7 14:34:04 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the equivalent absorber amounts for hydrometeors (clouds, fog, rain, snow, and cirrus/ice).

INTEGER FUNCTION IBKCNV
Created on: 8 November 1993
Revised on: Wed Apr 26 17:06:26 1995
Created by: Dr. William M. Cornette

This FUNCTION converts the ecosystem index into a MOSART terrain background scene index.

INTEGER FUNCTION IBNSRC
Created on: Wed Nov 18 15:53:01 1992
Revised on: Tue Nov 22 10:04:37 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the location of X0 in the X-array. The search is binary and starts at the location KEY. The binary division point is calculated using the gradient across the X-array for the interval.

INTEGER FUNCTION IDAERO
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:17 1994
Created by: Dr. William M. Cornette

This FUNCTION assigns a default aerosol type base upon the type of background and altitude.

INTEGER FUNCTION IGTINT
Created on: Wed Nov 18 15:53:08 1992
Revised on: Mon Apr 25 08:34:50 1994
Created by: Dr. William M. Cornette

This FUNCTION reads an INTEGER variable contained in free format in the CHARACTER string VARIAB.

SUBROUTINE IGTVEC
Created on: Wed Nov 18 15:53:12 1992
Revised on: Sat Jun 18 13:09:51 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads a INTEGER vector contained in free format in the CHARACTER string VARIAB.

COMPLEX FUNCTION INDEXI
Created on: Wed Nov 18 15:53:14 1992
Revised on: Mon May 17 16:40:57 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the complex index of refraction for ice.

COMPLEX FUNCTION INDEXW
Created on: Wed Nov 18 15:53:19 1992
Revised on: Tue Mar 1 07:55:31 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the complex index of refraction for water.

SUBROUTINE INDXBK
Created on: Wed Nov 18 15:53:22 1992
Revised on: Tue May 24 13:18:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE defines the background index.

INTEGER FUNCTION INDXSC
Created on: Wed Nov 18 15:53:25 1992
Revised on: Mon Aug 2 11:07:12 1993
Created by: Dr. William M. Cornette

This FUNCTION defines the scene label index.

SUBROUTINE INICPL
Created on: Wed Nov 18 15:53:28 1992
Revised on: Tue Nov 22 09:07:16 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the calculations for the multiple scattering coupling.

SUBROUTINE INIGEO
Created on: Wed Nov 18 15:53:35 1992
Revised on: Tue Nov 22 09:07:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the geometric parameters for the GEOM routine.

SUBROUTINE INITL
Created on: Wed Nov 18 15:53:38 1992
Revised on: Tue Nov 22 09:07:00 1994
Created by: Dr. William M. Cornette

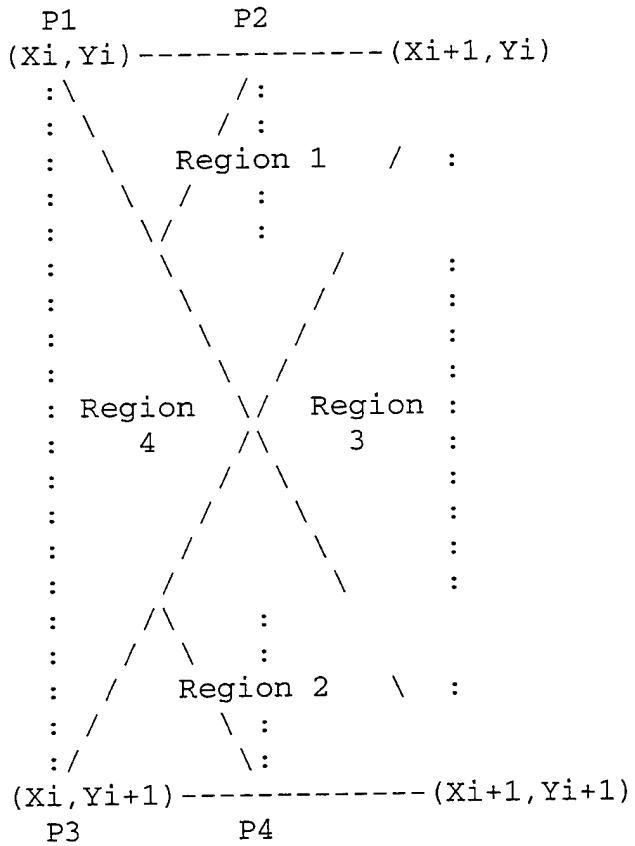
This SUBROUTINE reads in the MOSART input file.

SUBROUTINE INTEG
Created on: Wed Nov 18 16:00:10 1992
Revised on: Wed Oct 26 11:04:51 1994
Created by: Dr. William M. Cornette

This SUBROUTINE integrates each variable for a band average.

SUBROUTINE INTR2D
Created on: Wed Nov 18 15:44:44 1992
Revised on: Thu Jun 23 12:43:43 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the interpolation constants for a rectangular grid. First, the grid is searched to find the boundaries of the rectangular cell containing point (X0,Y0). The interpolation weights are defined as zero except for the four (4) points that define the boundary of the cell. The interpolation is designed to define a unique representation for each point in the cell, such that the center point is a equally weighted set of all four corner values. The cell is divided into four (4) triangular regions (see below) and if the (X,Y) point falls within a given region, its interpolation weights are determined by the two corner values and the center point that define the triangle.



Note: The code is designed to handle the degenerate case for one-dimension (i.e., NX=1 or NY=1), as well as the double degenerate case (i.e., NX=NY=1).

CHARACTER*72 FUNCTION IOERR
Created on: 3 August 1993
Revised on: Tue Mar 1 07:55:55 1994
Created by: Dr. William M. Cornette

This FUNCTION returns the appropriate error message for the input value of IOS. The FUNCTION returns the message that an end-of-file was encountered if IOS=-1 and that normal operation if IOS=0, in accordance with the ANSI X3.9-1978 FORTRAN 77 Standard. For all other values of IOS, the message is system dependent. The following systems are implemented:

- Unix (at least for SGI and HP. Not tested on others)
- PC Lahey F77L and F77L EM/32 compilers
- IBM VS
- VAX

A generic capability is also included. If your computer uses a different method for obtaining error messages, please notify the author.

SUBROUTINE ISRAEL
Created on: Wed Nov 18 15:53:43 1992
Revised on: Tue May 24 13:18:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE makes sure that the Israeli Standard Atmosphere is correct for day vs. night conditions.

INTEGER FUNCTION ISTAER
Created on: Wed Nov 18 15:53:46 1992
Revised on: Mon Nov 7 14:34:03 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the type of aerosol.

SUBROUTINE KDISTR
Created on: Wed Nov 18 15:48:11 1992
Revised on: Tue Nov 22 09:07:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE generates the k-distributions for the multiple scattering binary data file.

SUBROUTINE LAYLW
Created on: Wed Nov 18 15:49:01 1992
Created by: Dr. William M. Cornette

This SUBROUTINE computes the optical path and path-weighted temperature matrices from the vertical integrated absorber amounts.

SUBROUTINE LCTRIM
Created on: Wed Nov 18 15:49:04 1992
Created by: Dr. William M. Cornette

This SUBROUTINE trims any leading blanks from the character string CHRSTR.

INTEGER FUNCTION LENSTR
Created on: Wed Nov 18 15:49:06 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the length of the non-blank string contained in CHRSTR.

CHARACTER*(*) FUNCTION LWCASE
Created by: Dr. William M. Cornette
Created on: Tue Jul 28 14:49:15 1992
Revised on: Mon Aug 2 11:06:29 1993

This FUNCTION converts STRING from upper case to lower case.

SUBROUTINE LYRINT
Created on: Wed Nov 18 15:49:14 1992
Revised on: Thu Jun 23 12:43:40 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the layers for heat transfer calculations.

SUBROUTINE MARINE
Created on: Wed Nov 18 15:49:32 1992
Revised on: Thu Jun 23 12:43:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the aerosol extinction and absorption coefficients for the Navy Maritime model.

INTEGER FUNCTION MDLATM
Created on: Wed Nov 18 15:49:36 1992
Revised on: Thu Feb 11 15:24:38 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the model atmosphere number from the latitude index and the season index.

SUBROUTINE MIE
Created on: Wed Nov 18 15:49:38 1992
Revised on: Thu Jun 23 12:43:32 1994

This SUBROUTINE calculates extinction, total scattering, and asymmetry parameters for a given size parameter and relative refractive index.

SUBROUTINE MIEINP
Created on: Wed Nov 18 15:49:41 1992
Revised on: Tue Nov 22 09:07:07 1994
Created by: Dr. William M. Cornette

This SUBROUTINE will read in the parameters for the Mie calculations.

SUBROUTINE MIEPHS
Created on: Wed Nov 18 15:49:45 1992
Revised on: Thu Jun 23 12:43:27 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the absorption and scattering coefficients, the asymmetry factor, and the polarized phase matrix.

SUBROUTINE MLSCAT
Created on: Wed Nov 18 15:49:47 1992
Revised on: Mon Nov 7 14:33:44 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the multiple scattering terms.

SUBROUTINE MODBCK
Created on: Wed Feb 24 11:29:35 1993
Revised on: Thu May 20 15:01:37 1993
Created by: Dr. William M. Cornette

This SUBROUTINE modifies the background parameters for snow conditions.

INTEGER FUNCTION MONTH
Created on: Wed Nov 18 15:49:55 1992
Revised on: Mon Aug 2 13:11:34 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the month of the year from a CHARACTER argument. For example, if the CHARACTER argument is either 'JAN', 'Jan', 'jan', or '1', the function returns the value of 1 for the first month.

PROGRAM MOSART
Created on: Wed Nov 18 15:49:58 1992
Revised on: Tue Nov 22 09:07:01 1994
Created by: Dr. William M. Cornette

Moderate Spectral Atmospheric Radiance and Transmittance Code

SUBROUTINE MRNDFL
Created on: Wed Nov 18 15:50:02 1992
Created by: Dr. William M. Cornette

This SUBROUTINE determines the parameters for the Navy marine aerosol model.

INTEGER FUNCTION NCHAER
Created on: Wed Nov 18 15:49:55 1992
Revised on: Tue Jun 28 08:00:21 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the aerosol model index from a CHARACTER argument. For example, if the CHARACTER argument is either 'RU', 'Ru', 'ru', or '1 ', the function returns the value of 1 for the Rural Aerosol Model.

INTEGER FUNCTION NCHATM
Created on: Wed Nov 18 15:49:55 1992
Revised on: Mon Aug 2 11:04:39 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the model atmosphere index from a CHARACTER argument. For example, if the CHARACTER argument is either 'EQUATO', 'Equato', 'equato', or '1 ', the function returns the value of 1 for the Equatorial Model Atmosphere.

INTEGER FUNCTION NCHAZE
Created on: Wed Nov 18 15:49:55 1992
Revised on: Tue Jun 28 08:00:21 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the haze profile index from a CHARACTER argument. For example, if the CHARACTER argument is either 'BACKGR', 'Backgr', 'backgr', or '1 ', the function returns the value of 1 for Background.

INTEGER FUNCTION NCHSEA
Created on: Wed Nov 18 15:49:55 1992
Revised on: Tue Jun 28 08:00:21 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the season index from a CHARACTER argument. For example, if the CHARACTER argument is either 'SUMMER', 'Summer', 'summer', or '1 ', the function returns the value of 1 for Spring/Summer.

INTEGER FUNCTION NCYCLE
Created on: Wed Nov 18 15:50:18 1992
Revised on: Thu Feb 11 15:33:38 1993
Created by: Dr. William M. Cornette

This FUNCTION functions in a mode similar to the generic MOD function, only the value returned varies from 1 to NMOD, rather than 0 to NMOD-1. If the value is negative, it is added to NMOD.

SUBROUTINE NXXPAU
Created on: Wed Nov 18 15:50:21 1992
Revised on: Mon May 17 16:40:52 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the location of the tropopause according to the definition of the conventional tropopause of the World Meteorological Organization:

> The conventional tropopause is the lowest altitude at which the lapse rate decreases to 2 deg C/km or less, provided also that the average lapse rate between this altitude and all higher altitudes within two kilometers does not exceed 2 deg C/km.

Note - The lapse rate equals -DTDZ (i.e., the rate of decrease of temperature with altitude. The average lapse rate is the difference between the temperatures at the respective end points divided by the altitude interval, irrespective of the lapse-rate variations in between the end points. All higher altitudes mean that no point on the profile in the two-kilometer interval above the lowest altitude can fall to the left of the 2 deg C/km line extending from the lowest altitude.

Reference - Air Weather Service Manual AWSM 105-124 Dated 15 July 1969, Page 6-19, Paragraph 6.10.1

Also, the stratopause and mesopause are also calculated.

Note: If any of the values are meaningless, then default values of 10 km, 35 km, and 75 km are used for the tropopause, stratopause, and mesopause, respectively.

REAL FUNCTION O2CNT
Created on: Wed Nov 18 15:47:42 1992
Revised on: Tue Mar 1 07:55:43 1994
Created by: Dr. William M. Cornette

This FUNCTION provides the oxygen continuum coefficients as a function of wavenumber and temperature.

SUBROUTINE OPATH
Created on: Wed Nov 18 15:47:45 1992
Revised on: Thu Jun 23 12:43:22 1994
Created by: Dr. William M. Cornette

This SUBROUTINE performs the vertical integration to obtain the layer absorber amounts, optical paths, flux transmissivity, and optical path matrices.

SUBROUTINE OPNSCR
Created on: Wed Nov 18 15:47:47 1992
Revised on: Tue Nov 2 10:43:14 1993
Created by: Dr. William M. Cornette

This SUBROUTINE OPENs a scratch file on an available file unit.

SUBROUTINE PARSE
Created on: Wed Nov 18 15:59:33 1992
Revised on: Thu Jun 23 12:43:39 1994
Created by: Dr. William M. Cornette

This SUBROUTINE parses the CHARACTER string VARIN and places one field in each CHARACTER string VAROUT.

REAL FUNCTION PARTIT
Created on: Wed Nov 18 15:59:36 1992
Revised on: Wed Jun 15 14:01:11 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the vibration and rotation partition functions, relative to a reference temperature, for a variety of different molecules.

REAL FUNCTION PFR
Created on: Wed Nov 18 15:59:39 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates H2O partition function corrections.

SUBROUTINE PHFUNC
Created on: Wed Nov 18 15:59:45 1992
Revised on: Thu Jun 23 12:43:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the scattering phase function for a specified set of aerosols and hydrometeors.

REAL FUNCTION PHMLSC
Created on: Fri May 26 14:38:54 1995
Revised on: Fri May 26 15:32:23 1995
Created by: Dr. William M. Cornette

This FUNCTION calculates the single scattering phase function for molecular scattering.

Reference: Cornette, "Suggested modification to the total volume molecular scattering coefficient in LOWTRAN," Applied Optics, Vol. 19 (1980), pp A182-3.

SUBROUTINE PHYDRO
Created on: Wed Nov 18 15:59:48 1992
Revised on: Thu Jun 23 12:43:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the scattering phase function for a specified set of hydrometeors.

REAL FUNCTION PLANCK
Created on: Wed Nov 18 15:59:51 1992
Revised on: Tue Nov 2 10:42:47 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the spectral blackbody curve (Planck function) ($W/cm^2/cm^{-1}$).

SUBROUTINE PLANET
Created on: Wed Nov 18 15:59:54 1992
Revised on: Tue Nov 2 10:42:22 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the perturbation on the solar ephemeris due to the moon and planets.

SUBROUTINE PLMSUB
Created on: Wed Nov 18 16:00:00 1992
Revised on: Mon Nov 7 14:34:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the parameters for the plume file.

DOUBLE PRECISION FUNCTION POLY
Created on: Wed Nov 18 16:00:05 1992
Revised on: Mon Aug 2 11:06:55 1993

This FUNCTION calculates the polynomial C1+C2*X+...+CN*X**N-1 .

SUBROUTINE PRALT
Created on: Wed Nov 18 16:00:07 1992
Revised on: Tue Mar 1 07:55:41 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the pressure altitude (km) from the pressure, assuming the U.S. Standard (1976) Atmosphere. If the pressure is greater than 1777.6 mb or less than 0.0044568 mb, the altitude is set to 0.0, and the error flag is set.

SUBROUTINE PRCALC
Created on: Wed Nov 18 16:00:10 1992
Revised on: Tue Nov 22 09:07:07 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the transmittance and radiance for the observer-source-background, observer-source-solar/lunar, observer-background-solar/lunar paths, plus skyshine on source and background.

SUBROUTINE PRETEM
Created on: Wed Nov 18 16:00:25 1992
Revised on: Mon Nov 7 14:34:01 1994
Created by: Dr. William M. Cornette

This SUBROUTINE computes the vertical profiles of temperature altitude, H_2O, CO_2, and O_3 as a function of pressure. The pressure runs from 10 to 1010 mb in increments of 10 mb.

SUBROUTINE PROFAC
Created on: Wed Nov 18 16:00:28 1992
Revised on: Mon May 17 17:33:59 1993
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the parameters required for interpolation.

SUBROUTINE PROMPT
Created on: Wed Nov 18 16:00:30 1992
Revised on: Tue Mar 1 07:55:50 1994
Created by: Dr. William M. Cornette

This SUBROUTINE uses non-standard FORTRAN (where possible) so that a screen prompt does not give a line feed (or carriage return) immediately after writing the string.

SUBROUTINE PRTHDR
Created by: Dr. William M. Cornette
Created on: Tue Nov 22 09:07:13 1994
Revised on: Tue Jun 28 12:34:24 1994

This SUBROUTINE prints the MOSART file header in ASCII form.

SUBROUTINE PTHOSB
Created on: Wed Nov 18 16:00:41 1992
Revised on: Tue Nov 22 09:07:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the path radiance and variation along the observer-source-background path.

SUBROUTINE PTHTAU
Created on: Wed Nov 18 16:00:45 1992
Revised on: Mon Nov 7 14:34:01 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the transmittance along a path. Either the final transmittance or the incremental transmittances are calculated.

SUBROUTINE PUTCLD
Created on: Wed Nov 18 16:00:50 1992
Revised on: Tue Nov 22 09:07:07 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the cloud summary data.

SUBROUTINE PUTHDR
Created on: Wed Nov 18 16:00:54 1992
Revised on: Mon Nov 28 10:08:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the header for the various binary data files.

SUBROUTINE PUTSLR
Created on: Wed Nov 18 16:00:57 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the solar, lunar, and ephemeris summary data.

REAL FUNCTION RAB
Created on: Wed Nov 18 16:01:08 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the three layer composite reflection function from above given individual layer reflection and transmission functions.

REAL FUNCTION RADFLD
Created on: Wed Nov 18 16:01:12 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the radiation field for the absorption coefficients.

REAL FUNCTION RADTRX
Created on: Wed Nov 18 16:01:16 1992
Revised on: Mon May 17 17:34:01 1993
Created by: Dr. William M. Cornette

This FUNCTION performs the integral of Y(X)/X between X1 and X2 assuming Y/X and X vary exponentially with respect to the free parameter R.

REAL FUNCTION RADTRY
Created on: Wed Nov 18 16:01:18 1992
Revised on: Mon May 17 17:34:04 1993
Created by: Dr. William M. Cornette

This FUNCTION performs the integral of Y(X) between X1 and X2 assuming Y varies exponentially with respect to the parameter X.

REAL FUNCTION RAINEX
Created on: Wed Nov 18 16:01:22 1992
Revised on: Mon May 17 17:34:07 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the extinction coefficient for rain, based upon the assumption that the drop diameter is large relative to the wavelength so that the Mie extinction efficiency is independent of wavelength (Qext=2.0). This assumes that the drop diameter is between 0.1 and 10 mm.

SUBROUTINE RAINSP
Created on: Wed Nov 18 16:01:24 1992
Revised on: Thu Jun 23 12:42:49 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the normalized (to 0.55 μm) absorption and scattering coefficients for rain.

SUBROUTINE RAYPTH
Created on: Wed Nov 18 16:01:28 1992
Revised on: Mon Nov 7 14:34:00 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the geometric parameters for a specified ray path through a spherically isotropic atmosphere.

REAL FUNCTION RBE
Created on: Wed Nov 18 16:01:30 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the three layer composite reflection function from below given individual layer reflection and transmission functions.

SUBROUTINE RDFLTR
Created on: Wed Nov 18 16:01:35 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the user-defined filter response.

SUBROUTINE RDGBL
Created on: Mon Mar 8 15:43:02 1993
Revised on: Tue Nov 22 09:07:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE obtains the global climatology parameters from the global data base, or sets defaults values.

SUBROUTINE RDLINE
Created on: Wed Nov 18 16:01:38 1992
Revised on: Wed Jun 15 14:01:21 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads an input buffer from unit IUNIT. It is assumed that the input file is structured in CHARACTER*80 lines with any line that is to be continued terminated by the '&' character. Any number of characters can be read subject to the limitation that only a string of the maximum length of OUTBUF will be returned. ISKIP characters and any leading blanks will be ignored in the first line read.

SUBROUTINE RDSCN
Created on: Mon Mar 8 15:43:02 1993
Revised on: Tue Nov 22 09:07:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads the scene type and the altitude from the scenes data base, or sets defaults values.

COMPLEX FUNCTION REFEST
Created on: Wed Nov 18 16:01:42 1992
Revised on: Mon Apr 25 08:34:55 1994
Created by: Dr. William M. Cornette

This FUNCTION estimates the complex index of refraction from the reflection coefficient.

DOUBLE PRECISION FUNCTION REFRAC
Created on: Wed Nov 18 16:01:49 1992
Revised on: Thu Jun 23 12:43:50 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the refractivity or modified refractivity of the earth's atmosphere.

Note - Refractivity, N = (n-1)*1.E+06, where n is the index of refraction.
Modified refractivity, M = (nr/re-1)*1.E-06, where re is the radius of the earth and r = re + h, where h is the altitude.

REAL FUNCTION RELHUM
Created on: Wed Nov 18 16:01:52 1992
Created by: Dr. William M. Cornette

This FUNCTION determines the relative humidity using a modified definition of the relative humidity as defined by the Twelfth Conference of Directors of the International Meteorological Organization (Resolution 166, dated 1947). The modification involves the expression of relative humidity as a fraction rather than a percentage.

SUBROUTINE RESOLV
Created on: Wed Nov 18 16:01:55 1992
Revised on: Thu Jun 23 12:43:42 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the increment of the calculations.

SUBROUTINE RSHINE
Created on: Wed Nov 18 16:01:58 1992
Revised on: Mon Nov 7 14:33:42 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the skyshine.

REAL FUNCTION SATUR
Created on: Wed Nov 18 16:02:09 1992
Revised on: Thu Jun 23 12:43:30 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the saturation level of water vapor or ice in ppmv.

REAL FUNCTION SCINTL
Created on: Wed Nov 18 16:02:12 1992
Revised on: Mon May 17 16:40:46 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the scintillation from the path averaged turbulence. Aperture averaging using the work of D.L. Fried (JOSA 57 (1967) pp. 169-175) is used.

SUBROUTINE SCNRIO
Created on: Wed Nov 18 16:02:15 1992
Revised on: Tue Nov 22 09:11:59 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the ray paths for the desired observer-source-background geometry scenario.

REAL FUNCTION SEAICE
Created on: Mon Mar 8 15:43:02 1993
Revised on: Tue May 2 16:38:12 1995
Created by: Dr. William M. Cornette

This SUBROUTINE reads the scene type and the altitude from the scenes data base, or sets defaults values.

REAL FUNCTION SEATMP
Created on: 12 April 1993
Revised on: Tue Nov 2 10:42:47 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the ocean temperatures (K) at the surface for four seasons of the year. A temperature of zero (0.0) implies that only terrain exists in the 5 deg by 5 deg resolution cell.

COMPLEX FUNCTION SEAWTR
Created on: Wed Nov 18 16:02:19 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the complex dielectric constant of water and sea water by the Debye formula.

Reference: Saxton and Lane, Wireless Engineer, Oct. 1952.

SUBROUTINE SETALT
Created on: Wed Nov 18 16:02:21 1992
Revised on: Mon Nov 7 14:33:59 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the altitude grid points.

SUBROUTINE SETBCK
Created on: Wed Nov 18 16:02:26 1992
Revised on: Tue Nov 22 09:07:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE sets the background parameters.

SUBROUTINE SETFLG
Created on: Wed Nov 18 16:02:29 1992
Revised on: Mon Apr 25 08:34:59 1994
Created by: Dr. William M. Cornette

This SUBROUTINE sets the flags for various calculational paths.

SUBROUTINE SETUP
Created on: Mon Jan 6 14:37:32 1992
Revised on: Thu Jun 23 12:43:45 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provided the inputs for the skyshine rays.

REAL FUNCTION SHADOW
Created on: Wed Nov 18 16:02:39 1992
Revised on: Tue Nov 2 10:42:47 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the self-shadowing of a rough surface.

SUBROUTINE SHNGEO
Created on: Wed Nov 18 16:02:42 1992
Revised on: Tue Nov 22 09:07:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the geometric parameters for the scattered solar/lunar irradiance.

SUBROUTINE SKYNOI
Created on: Wed Nov 18 16:02:46 1992
Revised on: Tue May 24 13:18:21 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines the temperature variations for the skynoise calculations.

REAL FUNCTION SLPOS
Created on: Wed Nov 18 16:02:50 1992
Revised on: Thu Jun 23 12:43:28 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the solar or lunar positions given latitude and longitude of the sub-solar/lunar point, including the effects of refraction.

REAL FUNCTION SLRCNT
Created on: Wed Nov 18 16:02:55 1992
Revised on: Tue Mar 1 07:55:46 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the exoatmospheric solar constant (W/m^2).

REAL FUNCTION SLUNAR
Created on: Wed Nov 18 16:02:58 1992
Revised on: Thu Jun 23 12:43:38 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the lunar exoatmospheric irradiance ($W/cm^2/cm^{-1}$).

SUBROUTINE SMPCAL
Created on: Wed Nov 18 16:03:02 1992
Revised on: Tue Nov 8 11:27:29 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the altitude dependent irradiance profiles for the simple solar calculations and the lunar calculations.

REAL FUNCTION SNOWEX
Created on: Wed Nov 18 16:03:07 1992
Revised on: Tue Mar 1 07:55:42 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the extinction due to falling snow at 0.55 μm.

SUBROUTINE SNOWSP
Created on: Wed Nov 18 16:03:14 1992
Revised on: Thu Jun 23 12:42:49 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the normalized (to 0.55 μm) absorption and scattering coefficients for snow.

SUBROUTINE SOIL
Created on: Wed Nov 18 16:03:16 1992
Revised on: Thu Jun 23 12:43:55 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the soil mean dielectric constant and variance by biphase mixture formula.

Reference: Wang and Schmugge, AE-18, No. 4, 1980 pp 288-293.

REAL FUNCTION SOLAR
Created on: Wed Nov 18 16:03:18 1992
Revised on: Tue Mar 1 07:55:46 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the exoatmospheric solar spectral irradiance ($W/cm^2/cm^{-1}$).

SUBROUTINE SOLBND
Created on: Wed Nov 18 16:03:22 1992
Revised on: Tue Nov 22 09:07:17 1994
Created by: Dr. William M. Cornette

This SUBROUTINE computes the layer optical properties in the solar band and then performs the radiative transfer.

SUBROUTINE SOLRAD
Created on: Wed Nov 18 16:03:25 1992
Revised on: Tue Nov 22 09:07:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the various solar radiation parameters. It is also used for the lunar radiation parameters.

SUBROUTINE SPCLYR
Created on: Wed Nov 18 16:03:36 1992
Revised on: Thu Jun 23 12:43:49 1994
Created by: Dr. William M. Cornette

This SUBROUTINE specifies the properties of the sublayer.

REAL FUNCTION SPHAIR
Created on: Wed Jan 5 16:03:47 1995
Revised on: Tue May 2 16:38:11 1995
Created by: Dr. William M. Cornette

This FUNCTION calculates the specific heat of air as a function of water vapor content (W-sec/gm/K).

REAL FUNCTION SPHICE
Created on: Wed Nov 18 16:03:47 1992
Revised on: Mon May 17 16:42:59 1993

This FUNCTION calculates the specific heat of ice as a function of temperature (W-sec/gm/K).

REAL FUNCTION SPHWTR
Created on: Wed Nov 18 16:03:56 1992
Revised on: Mon May 17 16:42:24 1993

This FUNCTION calculates the specific heat of water as a function of temperature (W-sec/gm/K).

SUBROUTINE SPROD
Created on: Wed Nov 18 16:03:58 1992
Created by: Dr. William M. Cornette

This SUBROUTINE computes the layer diffuse flux that is produced from the solar beam using the particular solution to the two-stream approximation. (Ref. J. Jafolla, Ph.D. Thesis, 1981).

SUBROUTINE SPTRIG
Created on: Wed Nov 18 16:04:02 1992
Revised on: Tue Apr 6 16:00:03 1993
Created by: Dr. William M. Cornette

This SUBROUTINE determines the latitude and longitude of a point a given angular distance away from a reference latitude and longitude.

SUBROUTINE SRAT
Created on: Wed Nov 18 16:04:05 1992
Revised on: Thu Jun 23 12:43:42 1994
Created by: Dr. William M. Cornette

This SUBROUTINE computes the spherical atmosphere correction to the layer local zenith angle (Ref. J. Jafolla, Ph.D. Thesis, 1981).

SUBROUTINE SRCFLX
Created on: Wed Nov 18 16:04:09 1992
Revised on: Tue Nov 22 09:07:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the flux (up and down longwave; up, down, and beam shortwave) at the source altitude.

SUBROUTINE SRCGEO
Created on: Wed Nov 18 16:04:15 1992
Revised on: Tue Nov 22 09:07:16 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the geometric parameters for a point source (e.g., sun or moon).

SUBROUTINE SRCIRR
Created on: Mon Jan 6 14:37:32 1992
Revised on: Tue Nov 22 09:07:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the ray paths for the solar irradiance and sky/earthshine at the source.

REAL FUNCTION SRFLUX
Created on: Wed Nov 18 16:04:30 1992
Revised on: Thu Jun 23 12:43:38 1994

This FUNCTION calculates the heat flux at the surface.

SUBROUTINE SRTLAY
Created on: Wed Nov 18 16:04:37 1992
Revised on: Tue Nov 22 09:07:17 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the two stream spherical R and T values.

REAL FUNCTION STARAD
Created on: Wed Nov 18 16:04:40 1992
Revised on: Mon May 17 17:34:28 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the spectral mean space background due to stars in $W/sr/cm^2/cm^{-1}$.

SUBROUTINE STGEOM
Created on: Wed Nov 18 16:04:43 1992
Revised on: Mon Nov 7 14:34:14 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the geometry index based upon an input CHARACTER string.

REAL FUNCTION STRCN2
Created on: Wed Nov 18 16:04:49 1992
Revised on: Mon Nov 7 14:33:58 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the index of refraction structure constant, Cn^2.

SUBROUTINE SUMFIL
Created on: Wed Nov 18 16:04:53 1992
Revised on: Tue Nov 22 09:07:03 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out a summary of the environmental conditions represented on the main header.

REAL FUNCTION SUPK
Created on: Wed Nov 18 16:04:57 1992
Revised on: Mon Aug 2 11:06:25 1993
Created by: Dr. William M. Cornette

This FUNCTION computes the super kinetic line profile factor.

SUBROUTINE SWAT
Created on: Wed Nov 18 16:04:59 1992
Created by: Dr. William M. Cornette

This SUBROUTINE computes the three (up, down diffuse, down direct) stream solar band fluxes using a recursive adding technique (Ref. J. Jafolla, Ph.D. Thesis, 1981).

SUBROUTINE TANGPT
Created on: Wed Nov 18 15:50:35 1992
Revised on: Tue Nov 22 09:07:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE determines if a tangent point exists along a ray path. If it does, it adds the appropriate data to the arrays.

SUBROUTINE TERMPR
Created on: Wed Nov 18 15:52:14 1992
Revised on: Mon Nov 7 14:33:45 1994
Created by: Dr. William M. Cornette

This SUBROUTINE loads background index and establishes the projection of the solar/lunar ray on the background surface.

REAL FUNCTION THCAIR
Created on: Wed Jan 5 15:52:29 1995
Revised on: Tue May 2 16:38:11 1995
Created by: Dr. William M. Cornette

This FUNCTION calculates the thermal conductivity of air as a function of temperature (W/m/K).

REAL FUNCTION THCICE
Created on: Wed Nov 18 15:52:11 1992
Revised on: Mon May 17 16:43:20 1993

This FUNCTION calculates the thermal conductivity of ice as a function of temperature (W/m/K).

REAL FUNCTION THCSNW
Created on: Wed Nov 18 15:52:22 1992
Revised on: Tue Nov 2 10:42:34 1993

This FUNCTION calculates the thermal conductivity of snow as a function of density (W/m/K).

REAL FUNCTION THCWTR
Created on: Wed Nov 18 15:52:29 1992
Revised on: Mon May 17 16:43:16 1993

This FUNCTION calculates the thermal conductivity of water as a function of temperature (W/m/K).

SUBROUTINE TITLCR
Created on: Wed Nov 18 15:52:32 1992
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE creates the standard portion of the title used as part of the first record in the MOSART binary data files.

SUBROUTINE ADDARR
Created on: Wed Nov 18 15:52:32 1992
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

DISCLAIMER: This routine was extracted from a document on how to obtain the time and date from an RS/6000 machine. It has not been tested.

The routine ADDARR is utterly stupid and should perhaps be called 'COPY'. The trick is that our program calls it by value, passing the address, and picks the result by reference, allowing access of the array. Maybe there is a smarter way of doing this, without the need of generating a new copy of the data.

REAL FUNCTION TMPCLD
Created on: Wed Nov 18 15:52:36 1992
Revised on: Thu Jun 23 12:43:48 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the temperature of a cloud based upon its radiance.

AD - INTEGER Variable - Cloud radiance ($\mu W/cm^2/sr$)

SUBROUTINE TRANLW
Created on: Wed Nov 18 15:52:40 1992
Revised on: Tue Mar 1 07:55:51 1994
Created by: Dr. William M. Cornette

This SUBROUTINE does a table look up with 2D interpolation from the Staley & Jurica tables to calculate an element TF(K,L) in the total flux transmissivity matrix. Ref. Staley, D.O., and G.M. Jurica, 1974, JAM, 9, 365-372.

SUBROUTINE TRNSMT
Created on: Wed Nov 18 15:52:43 1992
Revised on: Mon Nov 7 14:33:57 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the total transmittance and the transmittance due to absorption.

SUBROUTINE TURBUL
Created on: Wed Nov 18 15:52:46 1992
Revised on: Wed Jun 15 14:01:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the turbulence parameters.

REAL FUNCTION UDIF
Created on: Wed Nov 18 15:45:33 1992
Created by: Dr. William M. Cornette

This FUNCTION calculates the three layer composite upward diffuse flux from solar beam given individual layer upward diffuse from solar fluxes and two-stream reflection and transmission functions.

SUBROUTINE UDLAY
Created on: Wed Nov 18 15:45:36 1992
Revised on: Tue Nov 22 09:07:16 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the diffuse upper and lower reflectances using a three-stream radiative transfer methodology.

CHARACTER*(*) FUNCTION UPCASE
Created by: Dr. William M. Cornette
Created on: Tue Jul 28 14:49:15 1992
Revised on: Mon Aug 2 11:06:27 1993

This FUNCTION converts STRING from lower case to upper case.

SUBROUTINE USRBCK
Created on: Wed Nov 18 15:45:52 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads the user-defined background file and loads the appropriate arrays.

SUBROUTINE USRCLD
Created on: Wed Nov 18 15:45:59 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the user-defined hydrometeor file.

SUBROUTINE USRDEF
Created on: Wed Nov 18 15:45:56 1992
Revised on: Tue Nov 22 09:07:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the user-defined atmospheric parameters.

REAL FUNCTION VIRIAL
Created on: Wed Nov 18 15:46:17 1992
Revised on: Tue May 2 16:38:11 1995
Created by: Dr. William M. Cornette

This SUBROUTINE determines the second and third virial coefficients for moist air.

REAL FUNCTION VISRH
Created on: Wed Nov 18 15:44:44 1993
Revised on: Mon Apr 25 08:35:00 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the meteorological range in km based upon the relative humidity, based on Hanel (1972).

SUBROUTINE VSA
Created on: Wed Nov 18 15:46:24 1992
Revised on: Tue May 24 13:17:44 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the vertical structure profile of aerosol density near the ground, including clouds and fog, at 9 altitudes between 0 and 2 km.

REAL FUNCTION XMCONV
Created on: Wed Nov 18 15:46:38 1992
Revised on: Thu Jun 23 12:43:29 1994
Created by: Dr. William M. Cornette

This FUNCTION converts the various types of units for molecular concentrations to ppmv.

SUBROUTINE XPNDAR
Created on: Wed Nov 18 15:46:41 1992
Revised on: Mon May 17 16:43:07 1993
Created by: Dr. William M. Cornette

This SUBROUTINE expands a partially filled array. The part of the array that has been filled must be ordered in X.

REAL FUNCTION XTERP
Created on: Wed Nov 18 15:46:44 1992
Revised on: Wed Oct 26 11:04:56 1994
Created by: Dr. William M. Cornette

This FUNCTION performs interpolation on the function Y(X) to determine the value Y(X0). The search for the adjacent points in X(I) to the value X0 starts at X(KEY). If X0 falls outside the range of X(I), then either the value X(1) or X(N) is used, depending on whether X0 is less than X(1) or greater than X(N), respectively.

REAL FUNCTION ZLAT
Created on: Wed Nov 18 15:46:58 1992
Revised on: Thu Jun 23 12:43:32 1994
Created by: Dr. William M. Cornette

This FUNCTION determines the zodiacal latitude.

REAL FUNCTION ZODICL
Created on: Wed Nov 18 15:47:05 1992
Revised on: Tue Jun 28 08:00:22 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the zodiacal light, employing a Lorentzian dust distribution. The radiance is calculated as a function of wavelength and geocentric ecliptic elongation and latitude.

SUBROUTINE ZROHDR
Created on: Wed Nov 18 15:47:12 1992
Revised on: Tue Nov 22 09:07:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE zeros the MOSART file header.

SUBROUTINE ZROINT
Created on: Wed Nov 18 15:47:14 1992
Revised on: Wed Oct 26 11:04:47 1994
Created by: Dr. William M. Cornette

This SUBROUTINE zeroes the summation variables for the spectral integration.

WRAPPER:

C Language Wrapper for the MOSART Code

CLEAR:

This routine is for use on a Sun computer to suppress the warning messages for Inexact and Underflow conditions.

3.2 Block Data Modules

The BLOCK DATA modules contained in the MOSART program are listed below in alphabetical order. A brief description and the Creation Date and the Revision Date are provided for each module.

BLOCK DATA ARSABD
Created on: Wed Nov 18 16:06:03 1992
Revised on: Tue May 4 12:03:52 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the model aerosols absorption coefficients.

BLOCK DATA ARSLBD
Created on: Wed Nov 18 16:06:03 1992
Revised on: Tue May 4 12:03:07 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the model aerosols.

BLOCK DATA ARSXBD
Created on: Wed Nov 18 16:06:03 1992
Revised on: Tue May 4 12:03:55 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the model aerosols extinction coefficients.

BLOCK DATA ATMSBD
Created on: Wed Nov 18 16:06:07 1992
Revised on: Tue May 24 13:17:40 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the data for the model Atmospheres.

BLOCK DATA BKGDBD
Created on: Wed Nov 18 16:06:10 1992
Revised on: Tue May 24 13:17:39 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains all of the parameters for the earth background materials.

BLOCK DATA BKSTBD
Created on: Wed Nov 18 16:06:14 1992
Revised on: Mon May 17 16:35:56 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the parameters for the temperature-dependent background stratospheric aerosol model.

BLOCK DATA BRBNBD
Created on: Wed Nov 18 16:06:18 1992
Revised on: Tue Mar 1 07:55:52 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module provides the various constants for the broad-band, heat transfer calculations.

BLOCK DATA CFCBD
Created on:
Created by: Dr. William M. Cornette

This BLOCK DATA module provides the cross-sections for the chloro-fluorocarbons.

BLOCK DATA CHRCBD
Created on: Wed Nov 18 16:06:28 1992
Revised on: Tue Mar 1 07:55:45 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains miscellaneous CHARACTER strings.

BLOCK DATA CIRRBD
Created on: Wed Nov 18 16:06:31 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the asymmetry factors for the cirrus cloud models.

BLOCK DATA CLDRBD
Created on: Wed Nov 18 16:06:35 1992
Revised on: Tue May 4 09:13:21 1993
Created by: Dr. William M. Cornette

This module contains the cloud and rain data bases.

BLOCK DATA CROSBD
Created on: Wed Oct 2 09:41:44 1994
Revised on: Sun Nov 27 20:55:28 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the cross-sections of various molecules for which band parameters are not available.

BLOCK DATA DEVCBD
Created on: Wed Nov 18 16:08:22 1992
Revised on: Tue Nov 22 09:07:04 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module assigns file unit numbers for all files.

BLOCK DATA DSRTBD
Created on: Wed Nov 18 16:06:51 1992
Revised on: Mon Jul 5 11:41:48 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the desert aerosol extinction coefficients, absorption coefficients, and asymmetry parameters for four wind speeds: 0 m/sec, 10 m/sec, 20 m/sec, and 30 m/sec.

BLOCK DATA ECOSBD
Created on: 8 November 1993
Revised on: Tue May 2 16:38:12 1995
Created by: Dr. William M. Cornette

This BLOCK DATA contains the labels and conversions for the World Ecosystems (WE1.4D) data base, based on the Olson World Ecosystem Classes Version 1.4D. The data is a 10-minute GED grid with a mixed resolution of 10 to 30 minute. The positional error is unknown. Although there are 74 categories, 15 categories are not used, and two (2) categories are empty (i.e., City complexes CCX and Broadleaf Evergreen Scrub BES).

BLOCK DATA EMISBD
Created on: Wed Nov 18 16:06:57 1992
Revised on: Tue Mar 1 07:55:48 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the descriptions of various materials.

BLOCK DATA EXMLBD
Created on: Wed Nov 18 16:07:05 1992
Revised on: Wed Jun 15 14:01:10 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the data for the non-latitude dependent molecular profiles.

BLOCK DATA GLCFBD
Created on: Wed Nov 18 16:07:10 1992
Revised on: Tue Mar 1 07:55:47 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the Gauss-Legendre coefficients.

BLOCK DATA H2OBD
Created on: Wed Nov 18 16:07:13 1992
Revised on: Tue Mar 1 07:55:36 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the parameters for the self-broadened correction to the water vapor continuum at 260 K and 296 K.

BLOCK DATA HAZEBD
Created on: Wed Nov 18 16:07:21 1992
Revised on: Mon May 17 16:36:04 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the haze profiles.

BLOCK DATA ICEBD
Created on: Wed Nov 18 16:07:24 1992
Revised on: Mon May 17 16:36:01 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module provides the real and imaginary indices of refraction for ice.

BLOCK DATA INFLBD
Created on: Fri Mar 30 14:49:28 1990
Revised on: Sat Jun 18 13:09:45 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains a sample filter response spectral data file. The data contained in this sample file is for the photopic response of the human eye.

BLOCK DATA INPTBD
Created on: Wed Nov 18 16:08:25 1992
Revised on: Tue Nov 22 09:07:01 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains a sample input file.

BLOCK DATA LAGRBD
Created on: Wed Nov 18 16:08:28 1992
Revised on: Wed Nov 3 13:37:17 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the abscissas and weights for Laguerre integration. Also provided is the product of the weights, WLG, and the exponential of the abscissa, XLG, namely, WLGEX.

BLOCK DATA LUNPBD
Created on: Wed Nov 18 16:08:32 1992
Revised on: Wed Nov 3 13:37:16 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the lunar perturbations data selected from the Table of Motion of the Moon by Ernest W. Brown.

BLOCK DATA MARNBD
Created on: Wed Nov 18 16:08:36 1992
Revised on: Tue Mar 1 07:55:45 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the Navy Marine aerosol extinction and absorption data.

BLOCK DATA MOLNBD
Created on: Wed Oct 2 09:41:44 1994
Revised on: Mon Nov 7 14:33:37 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the names of the different molecules, aerosols, hydrometeors, and the like.

BLOCK DATA MOLPBD
Created on: Wed Nov 18 16:08:44 1992
Revised on: Tue Nov 22 09:07:11 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the data for the molecular partition functions.

BLOCK DATA NO2BD
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:14 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the cross-sections of NO_2 between 14095 and 49970 cm^{-1}.

BLOCK DATA O2CBD
Created on: Wed Nov 18 16:08:46 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the parameters for the oxygen continuum.

BLOCK DATA O2UVBD
Created on: Wed Nov 18 16:09:07 1992
Created by: Dr. William M. Cornette

This BLOCK DATA modules contains the Herzberg and Schumann-Runge O2 band model.

BLOCK DATA O3CWBD
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:15 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the cross-sections of the Chappuis and Wulf band of O3 between 9170 and 24565 cm^{-1}.

BLOCK DATA O3HHBD
Created on: Wed Nov 18 16:09:16 1992
Revised on: Tue May 24 13:18:18 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the data for the ozone Hartley Huggins cross-sections for a temperature of 273 K. The units are of

The data now includes Molina & Molina data at 273 K with the temperature dependence determined from the 195 K Harvard measurements employing the Bass algorithm, C0*(1+C1*T+C2*(T**2)). This is only for the wavelength range from 0.34 to 0.35 microns. Otherwise, the Bass data alone have been employed between 0.245 and 0.34 microns.

BLOCK DATA OCNTBD
Created on: 12 April 1993
Revised on: Mon Aug 2 09:52:44 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the ocean temperatures the surface for four seasons of the year. A temperature of zero (0.0) implies that only terrain exists in the 5 deg by 5 deg resolution cell.

BLOCK DATA PHFGBD
Created on: Wed Nov 18 16:09:31 1992
Revised on: Tue Mar 1 07:55:34 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the fog models.

BLOCK DATA PHHYBD
Created on: Wed Nov 18 16:09:34 1992
Revised on: Thu Feb 11 15:06:19 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the hydrometeor models.

BLOCK DATA PHMABD
Created on: Wed Nov 18 16:09:37 1992
Revised on: Tue Mar 1 07:55:35 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the relative humidity dependent boundary layer maritime aerosol.

BLOCK DATA PHOCBD
Created on: Wed Nov 18 16:09:42 1992
Revised on: Tue Mar 1 07:55:33 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the relative humidity dependent boundary layer oceanic aerosol.

BLOCK DATA PHRUBD
Created on: Wed Nov 18 16:09:45 1992
Revised on: Tue Mar 1 07:55:33 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the relative humidity dependent boundary layer rural aerosol.

BLOCK DATA PHSTBD
Created on: Wed Nov 18 16:09:51 1992
Revised on: Tue Mar 1 07:55:32 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for all stratospheric were extrapolated exponentially for 65 angles.

BLOCK DATA PHTRBD
Created on: Wed Nov 18 16:09:54 1992
Revised on: Tue Mar 1 07:55:30 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the relative humidity dependent tropospheric aerosol.

BLOCK DATA PHURBD
Created on: Wed Nov 18 16:09:58 1992
Revised on: Tue Mar 1 07:55:31 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the phase functions for the relative humidity dependent boundary layer urban aerosol.

BLOCK DATA RAINBD
Created on: Wed Nov 18 16:10:01 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the rain and snow model data.

BLOCK DATA REFRBD
Created on: Wed Nov 18 16:10:04 1992
Created by: Dr. William M. Cornette

This BLOCK DATA modules contains the parameters for the refractivity from 10 to 1000 GHz for H2O vapor and O2.

BLOCK DATA SCENBD
Created on: Wed Nov 18 16:10:07 1992
Revised on: Mon Jul 5 11:41:55 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains all of the parameters for the earth background scenes.

BLOCK DATA SICEBD
Created on: Wed Nov 18 16:10:01 1992
Revised on: Tue May 2 16:38:14 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the sea ice indices.

BLOCK DATA SLR1BD
Created on: Wed Nov 18 16:10:19 1992
Revised on: Thu Apr 13 17:35:24 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 100 and 10,000 cm^{-1}.

BLOCK DATA SLR2BD
Created on: Wed Nov 18 16:10:19 1992
Revised on: Thu Apr 13 17:35:32 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 10,001 and 20,000 cm^{-1}.

BLOCK DATA SLR3BD
Created on: Wed Nov 18 16:10:19 1992
Revised on: Thu Apr 13 17:35:37 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 20,001 and 30,000 cm^{-1}.

BLOCK DATA SLR4BD
Created on: Wed Nov 18 16:10:19 1992
Revised on: Thu Apr 13 17:35:43 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 30,001 and 40,000 cm^{-1}.

BLOCK DATA SLR5BD
Created on: Wed Nov 18 16:10:19 1992
Revised on: Thu Apr 13 17:35:48 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the spectral irradiance of the sun at the earth for the mean earth-sun distance above 40,001 cm^{-1}.

BLOCK DATA SNOWBD
Created on: Wed Nov 18 16:10:12 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the parameters for snow.

BLOCK DATA SO2BD
Created on: Wed Nov 18 15:44:44 1992
Revised on: Tue May 24 13:18:15 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the cross-sections of SO2 between 24820 and 52625 cm^{-1}.

BLOCK DATA STMLBD
Created on: Wed Nov 18 16:10:23 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the data for the latitude dependent molecular profiles.

BLOCK DATA UFTPBD
Created on: Thu Sep 22 1993
Revised on: Tue Mar 1 07:55:50 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the pointer information for the MODTRAN molecular data base file 'UFTAPE'.

BLOCK DATA UPPRBD
Created on: Wed Nov 18 16:10:41 1992
Revised on: Tue May 24 13:17:39 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the atmospheric profile above 100 km altitude.

BLOCK DATA VIRLBD
Created on: Wed Nov 18 16:10:45 1992
Revised on: Tue May 2 16:38:10 1995
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the virial coefficients for dry air, vapor, and the interaction coefficient as a function of temperature.

BLOCK DATA WTRBD
Created on: Wed Nov 18 16:10:52 1992
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the index of refraction for water.

BLOCK DATA ZOD1BD
Created on: Wed Nov 18 16:10:59 1992
Revised on: Tue May 4 09:12:03 1993
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the first set of the zodiacal light parameters.

BLOCK DATA ZOD2BD
Created on: Wed Nov 18 16:10:59 1992
Revised on: Tue Mar 1 07:55:47 1994
Created by: Dr. William M. Cornette

This BLOCK DATA module contains the second set of zodiacal light parameters.

3.3 ASCBIN

The routines contained in the ASCBIN program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

PROGRAM ASCBIN
Created on: Tue Sep 25 09:40:01 1990
Revised on: Tue Nov 22 09:07:01 1994
Created by: Dr. William M. Cornette

MOSART ASCII from Binary Computer Code.

SUBROUTINE CONVAB
Created on: Tue Sep 25 09:41:05 1990
Revised on: Tue Nov 29 10:37:17 1994
Created by: Dr. William M. Cornette

This SUBROUTINE converts an MOSART binary data file into an ASCII data file. It also converts the ASCII data file into an MOSART binary file.

SUBROUTINE SETFIL
Created on: Mon Jul 23 11:23:58 1990
Revised on: Thu Jun 23 12:43:25 1994
Created by: Dr. William M. Cornette

This SUBROUTINE checks for the existence of a file, and if it exists, it OPENs the file.

SUBROUTINE SLITFN
Created on: Fri Nov 20 12:05:04 1992
Revised on: Thu Jun 30 11:12:28 1994
Created by: Dr. William M. Cornette

This SUBROUTINE initializes the slit function variables and then step-wise convolves the input parameter with the slit function weights.

SUBROUTINE TABLEA
Created on: Wed Apr 3 10:29:45 1991
Revised on: Tue Nov 22 09:07:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provides the spectral data in an MOSART source binary data file in a tabular form.

SUBROUTINE TABLEB
Created on: Wed Apr 3 10:29:48 1991
Revised on: Tue Nov 22 09:07:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provides the spectral data in an MOSART background binary data file in a tabular form.

SUBROUTINE TABLEH
Created on: Wed Apr 3 10:29:48 1991
Revised on: Tue Nov 22 09:07:12 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provides the temporal data in an MOSART heat transfer binary data file in a tabular form.

SUBROUTINE TABLET
Created on: Wed Apr 3 10:29:48 1991
Revised on: Tue Nov 22 09:07:10 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provides the spectral data in an MOSART molecular transmittance binary data file in a tabular form.

3.4 BBTEMP

The routines contained in the BBTEMP program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

PROGRAM BBTEMP
Created on: Thu Jul 2 11:49:18 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

Blackbody Temperature Summary Program.

This PROGRAM reads the '.atm' binary data file from MOSART and convert the radiance values to equivalent blackbody temperatures (K).

REAL FUNCTION INVPLK
Created on: Thu Jul 2 11:49:21 1992
Revised on: Fri Mar 26 16:06:00 1993
Created by: Dr. William M. Cornette

This FUNCTION calculates the temperature corresponding to the spectral blackbody curve (Planck function).

3.5 CRFILE

The routines contained in the CRFILE program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section. Except for the driver routines, MSAG and MDRI, the components of the SAG code are not provided.

SUBROUTINE CNVJTK
Created on: Wed Nov 18 16:00:30 1992
Revised on: Tue Apr 5 17:30:17 1994
Created by: Dr. William M. Cornette

This SUBROUTINE converts the MODTRAN JCHAR string to the MOSART indexing scheme.

SUBROUTINE CRBKGD
Created on: Tue Sep 25 09:41:02 1990
Revised on: Tue Mar 1 07:47:02 1994
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART user-defined background data file.

PROGRAM CRFILE
Created on: Tue Sep 25 09:40:01 1990
Revised on: Tue Nov 22 09:07:05 1994
Created by: Dr. William M. Cornette

SUBROUTINE CRFLTR
Created on: Tue Sep 25 09:40:16 1990
Revised on: Thu Jun 23 12:43:25 1994
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART filter response file.

SUBROUTINE CRINPT
Created on: Tue Sep 25 09:39:58 1990
Revised on: Tue Nov 22 09:07:00 1994
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART input file.

SUBROUTINE CRUAER
Created on: Tue Sep 25 09:40:55 1990
Revised on: Tue Nov 2 10:43:27 1993
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART user-defined aerosol data file.

SUBROUTINE CRUATM
Created on: Tue Sep 25 09:40:13 1990
Revised on: Tue Nov 22 09:06:59 1994
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART user-defined atmosphere data file.

SUBROUTINE CRUCLD
Created on: Tue Sep 25 09:40:52 1990
Revised on: Tue Nov 2 10:43:25 1993
Created by: Dr. William M. Cornette

This SUBROUTINE creates the MOSART user-defined hydrometeor data file.

BLOCK DATA INARBD
Created on: Fri Mar 30 14:49:21 1990
Revised on: Sat Jun 18 13:09:45 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains a sample user-defined aerosol file.

BLOCK DATA INBKBD
Created on: Fri Mar 30 14:49:35 1990
Revised on: Sat Jun 18 13:09:44 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains a sample user-defined background and scene file.

BLOCK DATA INCLBD
Created on: Fri Mar 30 14:49:32 1990
Revised on: Sat Jun 18 13:09:43 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains a sample user-defined hydrometeor file.

SUBROUTINE MDRI
Created on: 6 July 1994
Created by: Dr. William M. Cornette

This SUBROUTINE has been modified to operate with CRFILE for MOSART user-defined files.

SUBROUTINE MENU
Created on: Mon Jul 23 11:24:00 1990
Revised on: Tue Mar 1 07:47:01 1994
Created by: Dr. William M. Cornette

This SUBROUTINE provides the keys and indices for the input to the MOSART code.

SUBROUTINE MSAG
Created on: Tue Mar 29 15:44:44 1994
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This SUBROUTINE drives the SHARC/SAMM Atmosphere Generator for use by MOSART.

BLOCK DATA NRLBD
Created on: 6 July 1994
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the file number and names of the NRL data bases.

SUBROUTINE RDMDTN
Created on: Wed Nov 18 16:00:30 1992
Revised on: Tue Nov 22 09:06:59 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads a MODTRAN input file and creates an equivalent (at least approximately) MOSART input file.

3.6 FACET

The routines in the FACET program are listed below in alphabetical order, together with a brief description and the Creation Date and Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

PROGRAM FACET
Created on: Thu Jun 23 12:36:15 1992
Revised on: Tue Nov 22 09:07:05 1994
Created by: Dr. William M. Cornette

This PROGRAM computes the emitted and reflected radiances from a unit area flat plate. Emissivities can be either

- Lambertian (diffuse) or
- directional,

depending upon the available data. Reflectivities can be either

- Lambertian (diffuse),
- directional, or
- bidirectional,

depending upon the available data. The emissivity and reflectivity are related as follows:

	Reflectivity		
	Diffuse	Directional	Bidirectional
Emissivity			
Diffuse	x		
Directional		x	x

REAL FUNCTION ROUGH
Created on: Wed Nov 18 15:43:15 1992
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the amount of energy reflected specularly from a rough surface. Losses are due to incoherent scattering and interference.

REAL FUNCTION SURFAC
Created on: Wed Nov 18 15:41:27 1992
Revised on: Mon Nov 7 14:34:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the facet element radiance.

3.7 FPTEST

The routines contained in the FPTEST program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

SUBROUTINE CKSTAT
Created on: Mon Aug 2 11:06:44 1993
Revised on: Thu Jun 23 12:43:48 1994
Created by: Dr. William M. Cornette

This SUBROUTINE checks for whether a code is running in static or dynamic mode and at what uninitialized variables are set.

REAL FUNCTION ZSTAT

LOGICAL FUNCTION FLCOL1
Created on: Thu Oct 28 1993
Revised on: Tue Nov 2 10:43:32 1993
Created by: Dr. William M. Cornette

This FUNCTION determines if a file written by the code can then be read by the code, or if column one is suppressed. A value of .TRUE. implies that the code can read a file that it has written.

PROGRAM FPTEST
Created on: Tue Sep 15 1992
Revised on: Tue Nov 22 09:07:06 1994
Created by: Dr. William M. Cornette

This PROGRAM tests certain numerical algorithms for calculating key floating point parameters that are machine dependent.

INTEGER FUNCTION LRECHK
Created on: Tue Sep 15 1992
Revised on: Mon Nov 7 14:34:12 1994
Created by: Dr. William M. Cornette

This FUNCTIONs calculates the record length for different length and type of records. Duplicate methods for declaring variables (e.g., REAL and REAL*4, DOUBLE COMPLEX and COMPLEX*16) are declared in the more conventional method, with the alternate method commented out. Also, non-ANSI standard variable types (e.g., LOGICAL*1, INTEGER*1) are also commented out. Each type is commented out with the following abbreviations:

"CINT1" for INTEGER*1
"CINT4" for INTEGER*4
"CRL4" for REAL*4
"CRL8" for REAL*8
"CCM6" for COMPLEX*8
"CCM16" for COMPLEX*16
"CLOG2" for LOGICAL*2
"CLOG4" for LOGICAL*4
"CIBM" for IBM
"CUNV" for Univac
"CDBL" for the INTRINSICs DCMPLX and DIMAG

3.8 INSTDB

The routines contained in the CRFILE program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

PROGRAM INSTDB
Created on: Thu Jul 2 09:36:53 1992
Revised on: Tue Nov 22 09:07:02 1994
Created by: Dr. William M. Cornette

This PROGRAM installs the MOSART data bases.

Note: To OPEN the direct access files on an IBM VM/CMS operating system, certain file parameters must be set. Remove the occurrences of 'CIBMV' below.

3.9 MRFLTR

The routines contained in the MRFLTR program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

SUBROUTINE ATMINT
Created on: Wed Nov 18 15:41:04 1992
Revised on: Tue Nov 22 09:07:05 1994
Created by: Dr. William M. Cornette

This SUBROUTINE integrates the spectral data from the source file.

SUBROUTINE ATMOUT
Created on: Wed Nov 18 15:41:07 1992
Revised on: Tue Nov 22 09:07:04 1994
Created by: Dr. William M. Cornette

This SUBROUTINE prints out the atmospheric parameters.

SUBROUTINE BCKINT
Created on: Wed Nov 18 15:41:30 1992
Revised on: Tue Nov 22 09:07:05 1994
Created by: Dr. William M. Cornette

This SUBROUTINE integrates the background spectral data.

SUBROUTINE GETHDR
Created on: Wed Nov 18 15:56:33 1992
Revised on: Tue Nov 22 09:07:11 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads the MOSART file header into the COMMON block HEADER.

PROGRAM MRFLTR
Created on: Wed Nov 18 15:49:58 1992
Revised on: Tue Nov 22 09:07:04 1994
Created by: Dr. William M. Cornette

MOSART Spectral Filter Response Convolution Code.

3.10 PLTGEN

The routines contained in the PLTGEN program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

SUBROUTINE AGUTOL
Created on: Wed Feb 13 16:13:10 1991
Revised on: Thu Jun 23 12:43:39 1994
Created by: Dr. William M. Cornette

This SUBROUTINE is used by the NCAR graphics package for mapping the various axis.

CHARACTER*(*) FUNCTION APPEND
Created on: Mon Jul 23 11:23:50 1990
Revised on: Thu Jun 23 12:43:36 1994
Created by: Dr. William M. Cornette

This FUNCTION appends STRNG2 at the end of the non-blank portion of STRNG1.

BLOCK DATA PLTBD
Created on: Wed Jan 2 09:41:44 1991
Revised on: Wed Jun 15 14:01:07 1994
Created by: Dr. William M. Cornette

This BLOCK DATA contains the standard plot parameter definition for all plot types.

SUBROUTINE PLTDRV
Created on: Thu Nov 15 10:59:11 1990
Revised on: Tue Nov 22 09:07:11 1994
Created by: Dr. William M. Cornette

This SUBROUTINE is the driver for setting up the plots.

PROGRAM PLTGEN
Created on: Tue Sep 25 09:40:50 1990
Revised on: Tue Nov 22 09:07:11 1994
Created by: Dr. William M. Cornette

This PROGRAM initializes plotting with installation specific routines. Please refer to the installation instructions for customizing for a specific installation. This PROGRAM is the driver for the NCAR graphics package.

SUBROUTINE RDMSRT
Created on: Wed Apr 3 10:29:52 1991
Revised on: Tue Nov 22 09:07:11 1994
Created by: Dr. William M. Cornette

This SUBROUTINE reads in the MOSART .atm binary output file. The file is OPENed outside the SUBROUTINE by the main driver.

3.11 VISUAL

The routines contained in the VISUAL program are listed below in alphabetical order, together with a brief description and the Creation Date and the Revision Date for each routine. Routines that are duplicates of routines in the MOSART program or other utility programs can be found in the appropriate section.

SUBROUTINE COLOR
Created on: Thu Jul 2 09:12:48 1992
Revised on: Fri Mar 26 16:14:42 1993
Created by: Dr. William M. Cornette

This SUBROUTINE determines the human eye color response.

SUBROUTINE HUMAN
Created on: Thu Jul 2 09:12:55 1992
Revised on: Mon Aug 2 09:57:22 1993
Created by: Dr. William M. Cornette

This FUNCTION determines the spectral lumen/watt response of the human eye, based on available background illumination.

SUBROUTINE NRMLZ
Created on: Thu Jul 2 09:12:58 1992
Revised on: Fri Mar 26 16:14:34 1993
Created by: Dr. William M. Cornette

This SUBROUTINE normalizes the terms X and Y by the sum X+Y+Z.

SUBROUTINE SUMIT
Created on: Thu Jul 2 09:13:07 1992
Revised on: Thu Jun 23 12:43:50 1994
Created by: Dr. William M. Cornette

This SUBROUTINE performs an incremental integration of the variable RV over the spectral interval DV for the weights FILTER, X, Y, and Z.

PROGRAM VISUAL
Created on: Thu Jul 2 11:49:56 1992
Revised on: Tue Nov 22 09:07:04 1994
Created by: Dr. William M. Cornette

This PROGRAM reads the '.atm' binary data file from APART for the human visual response region of the spectrum (0.34 - 0.78 microns), determines the appropriate eye spectral response (i.e., photopic, scotopic, or mesopic), calculates the environmental parameters in lumen and evaluates the color content of the parameters.

3.12 FACET

PROGRAM FACET
Created on: Thu Jan 23 12:36:15 1992
Revised on: Thu Apr 13 17:47:29 1995
Created by: Dr. William M. Cornette

This PROGRAM computes the emitted and reflected radiances from a unit area flat plate. Emissivities can be either

- Lambertian (diffuse) or
- directional,

depending upon the available data. Reflectivities can be either

- Lambertian (diffuse),
- directional, or
- bidirectional,

depending upon the available data. The emissivity and reflectivity are related as follows:

	Reflectivity		
	Diffuse	Directional	Bidirectional
Emissivity			
Diffuse	x		
Directional		x	x

REAL FUNCTION ROUGH
Created on: Wed Nov 18 15:43:15 1992
Revised on: Mon Nov 7 14:34:13 1994
Created by: Dr. William M. Cornette

This FUNCTION calculates the amount of energy reflected specularly from a rough surface. Losses are due to incoherent scattering and interference.

REAL FUNCTION SURFAC
Created on: Wed Nov 18 15:41:27 1992
Revised on: Mon Nov 7 14:34:15 1994
Created by: Dr. William M. Cornette

This SUBROUTINE calculates the facet element radiance.

3.13 SCNGEN

SUBROUTINE COEFF
Created on: Thu Jul 2 08:59:07 1992
Revised on: Thu Feb 2 13:30:26 1995
Created by: Dr. William M. Cornette

This SUBROUTINE generates the Fourier coefficients for the scene by using random numbers scaled by the PSD. Since the resulting scene is real valued, half of the complex Fourier coefficients are redundant and only half the array space is required.

REAL FUNCTION CORF
Created on: Thu Jul 2 08:59:10 1992
Revised on: Mon Aug 2 09:56:46 1993
Created by: Dr. William M. Cornette

This FUNCTION returns the spatial correlation function given the correlation length (defined as the correlation function at 1/e), the PSD frequency scale and the PSD power law index.

SUBROUTINE FM2D
Created on: Thu Jul 2 08:59:12 1992
Revised on: Fri Mar 26 16:12:17 1993
Created by: Dr. William M. Cornette

This SUBROUTINE performs a midpoint displacement and successive random additions in two dimensions.

SUBROUTINE FOUR1
Created on: Thu Jul 2 08:59:15 1992
Revised on: Thu Feb 2 13:30:06 1995
Created by: Dr. William M. Cornette

This SUBROUTINE performs the Cooley-Tukey Fast Fourier Transform.

TRNSFM(K)=sum(PDATA(J)*EXP(ISIGN*2*PI*SQRT(-1)*(J-1)*(K-1)/NN)),

summed over all J and K from 1 to NN. The rms relative error is bounded by 6*SQRT(2)*LOG2(NN)*2**(-B), where B is the number of bits in the floating point fraction.

The output has the form such that the 1st (complex) value corresponds to 0 freq, the next to + DELF, up to (N/2 -1) DELF, then -N/2 DELF to the last entry corresponding to -DELF, where DELF=1/NN.

REAL FUNCTION GAMMA
Created on: Thu Jul 2 08:59:17 1992
Revised on: Mon Aug 2 09:56:51 1993
Created by: Dr. William M. Cornette

This FUNCTION returns the gamma function of the argument for values of the argument greater than zero. It uses the polynomial approximation from the Handbook of Mathematical Functions (9th Dover printing) by Abramowitz and Stegun (page 257, 6.1.35).

REAL FUNCTION GAUS
Created on: Thu Jul 2 08:59:19 1992
Revised on: Mon Aug 2 09:56:50 1993
Created by: Dr. William M. Cornette

This FUNCTION produces Gaussian random numbers having the specified standard deviation by adding and scaling 12 uniform random numbers. The sum of 12 uniformly distributed random numbers on (a,-a) has standard deviation = 2a.

REAL FUNCTION KNU
Created on: Thu Jul 2 08:59:22 1992
Revised on: Mon Aug 2 09:56:43 1993
Created by: Dr. William M. Cornette

This FUNCTION returns the modified Bessel function K for values of the index greater than 0.5. It numerically evaluates an integral expression from The Handbook of Mathematical Functions (9th Dover edition) by Abramowitz and Stegun (page 376, 9.6.23). Accuracy is about three places.

SUBROUTINE RUNIF
Created on: Thu Jul 2 08:59:27 1992
Revised on: Fri Mar 26 16:11:55 1993
Created by: Dr. William M. Cornette

This FUNCTION is a random number generator that returns a value between 0. and 0. It is portable among a wide variety of computers. It generates a random number between 0.0 and 1.0 according to the algorithm presented by Bays and Durham (TOMS, 2, 59, 1976). The motivation for using this scheme, which resembles the Maclaren-Marsaglia method, is to greatly increase the period of the random sequence. If the period of the basic generator (UNI) is P, then the expected mean period of the sequence generated by RUNIF is given by new mean

$$P = SQRT (PI*FACTORIAL(N)/(8*P)),$$

where FACTORIAL(N) must be much greater than P in this asymptotic formula. Generally, N should be around 32 if P=4.E6 as for UNI.

This routine was modified from a routine written by W. Fullerton (LANL).

REAL FUNCTION SCALE
Created on: Thu Jul 2 08:59:29 1992
Revised on: Mon Aug 2 09:56:48 1993
Created by: Dr. William M. Cornette

This FUNCTION returns the frequency scale required for specification of the 1-dimensional PSD from the spatial correlation length and the power law index by using the Fourier transform relationship between the PSD and the correlation function. The correlation length is defined as the correlation function evaluated at 1/e. The algorithm evaluates the correlation function for various values of the frequency scale until the condition is satisfied.

PROGRAM SCNGEN
Created on: Thu Jul 2 08:59:38 1992
Revised on: Tue May 9 10:03:10 1995
Created by: Dr. William M. Cornette

This PROGRAM computes a 1024 x 1024 2-dimensional scene containing correlated random fluctuations described by a set of specified 1-dimensional PSDs. It is assumed that the fluctuations in the 2-dimensional scene are isotropic. Each PSD is completely described by a material correlation length, material scene variance, and material power law slope for each material in the scene. Different values of the input random number seed will produce statistically independent realizations of the scene. The 1-dimensional PSD for each material has the form,

```
PSD(KX)=2.*SQRT(PI)*VAR*(GAMMA(ALPHA/2.)/GAMMA((ALPHA-1.)/2.))
                /(K0*(1.+(KX/K0)**2)**(ALPHA/2.))
```

while the 2-dimensional PSD for each material has the form:

```
PSD2D=2.*PI*(ALPHA-1.)*VAR/(K0X*K0Y)*
((1.+(KX/K0X)**2+(KY/K0Y)**2)**(-(ALPHA+1.)/2.))
```

SUBROUTINE TDFFT
Created on: Thu Jul 2 08:59:41 1992
Revised on: Fri Mar 26 16:11:49 1993
Created by: Dr. William M. Cornette

This SUBROUTINE performs an in-place 2-dimensional FFT on the packed complex Fourier coefficients generated in COEFF and produces the real valued scene. It first partially unpacks the coefficients by creating one extra row in array UNPCK.

SUBROUTINE TILEIT
Created on: Wed Nov 18 15:44:44 1992
Revised on: Thu Feb 2 13:30:26 1995
Created by: Dr. William M. Cornette

This SUBROUTINE tiles a larger array using the results from a smaller array, with a smooth transition at the edges.

REAL FUNCTION UNI
Created on: Thu Jul 2 08:59:43 1992
Revised on: Fri Mar 26 16:11:46 1993
Created by: Dr. William M. Cornette

This FUNCTION is a pseudo-random number generator that produces numbers between 0. and 1. This code is portable among a wide variety of computers. UNI(R) undoubtedly is not as good as many readily available installation dependent versions, and so this routine is not recommended for widespread usage. Its redeeming feature is that the exact same random numbers (to within final round-off error) can be generated from machine to machine. Thus, programs that make use of random numbers can be easily transported to and checked in a new environment. The random numbers are generated by the linear congruential method described, e.g., by Knuth in Seminumerical Methods (pg. 9), Addison-Wesley, 1969. Given the I-th number of a pseudo-random sequence, the I+1 -st number is generated from

$$X(I+1) = (A*X(I) + C) \text{ MOD } M,$$

where here M = 2**22 = 4194304, C = 1731 and several suitable values of the multiplier A are discussed below. Both the multiplier A and random number X are represented in double precision as two 11-bit words. The constants are chosen so that the period is the maximum possible, 4194304. In order that the same numbers be generated from machine to machine, it is necessary that 23-bit integers be

reducible modulo 2**11 exactly, that 23-bit integers be added exactly, and that 11-bit integers be multiplied exactly. Furthermore, if the restart option is used (where R is between 0 and 1), then the product R*2**22 = R*4194304 must be correct to the nearest integer. The first four random numbers should be 0.0004127026, 0.6750836372, 0.1614754200, and 0.9086198807. The tenth random number is 0.5527787209, and the hundredth is 0.3600893021. The thousandth number should be 0.2176990509. In order to generate several effectively independent sequences with the same generator, it is necessary to know the random number for several widely spaced calls. The I-th random number times 2**22, where I=K*P/8 and P is the period of the sequence (P = 2**22), is still of the form L*P/8. In particular, we find the I-th random number multiplied by 2**22 is given by

I = 0 1*P/8 2*P/8 3*P/8 4*P/8 5*P/8 6*P/8 7*P/8 8*P/8
UNI = 0 5*P/8 2*P/8 7*P/8 4*P/8 1*P/8 6*P/8 3*P/8 0

Thus the 4*P/8 = 2097152 random number is 2097152/2**22. Several multipliers have been subjected to the spectral test (see Knuth, p. 82). Four suitable multipliers roughly in order of goodness according to the spectral test are

3146757 = 1536*2048 + 1029 = 2**21 + 2**20 + 2**10 + 5
2098181 = 1024*2048 + 1029 = 2**21 + 2**10 + 5
3146245 = 1536*2048 + 517 = 2**21 + 2**20 + 2**9 + 5
2776669 = 1355*2048 + 1629 = 5**9 + 7**7 + 1

In the table below LOG10(NU(I)) gives roughly the number of random decimal digits in the random numbers considered I at a time.

C is the primary measure of goodness. In both cases bigger is better.

	LOG10 NU(I)				C(I)			
A	I=2	I=3	I=4	I=5	I=2	I=3	I=4	I=5
3146757	3.3	2.0	1.6	1.3	3.1	1.3	4.6	2.6
2098181	3.3	2.0	1.6	1.2	3.2	1.3	4.6	1.7
3146245	3.3	2.2	1.5	1.1	3.2	4.2	1.1	0.4
2776669	3.3	2.1	1.6	1.3	2.5	2.0	1.9	2.6
Best Possible	3.3	2.3	1.7	1.4	3.6	5.9	9.7	14.9

This code has been modified from a code developed by W. Fullerton (LANL).

3.14 TERTEM

INTEGER FUNCTION NCHTER
Created on: Wed Nov 18 15:49:55 1992
Revised on: Tue May 9 10:03:08 1995
Created by: Dr. William M. Cornette

This FUNCTION determines the terrain material index from a CHARACTER argument. For example, if the CHARACTER argument is either 'ASPHALT', 'Asphalt', 'asphalt', or '64 ', the function returns the value of 64 for Asphalt.

SUBROUTINE RDUSRM
Created on: Wed Apr 2 15:49:55 1995
Revised on: Tue May 9 10:03:11 1995
Created by: Dr. William M. Cornette

This SUBROUTINE reads in and initializes user-defined terrain materials for TERTEM.

PROGRAM TERTEM
Created on: Thu Aug 5 15:42:16 1994
Revised on: Fri May 26 15:32:25 1995
Created by: Dr. William M. Cornette

This PROGRAM calculates the terrain material temperatures for the GENESSIS code.

4.0 ROUTINE DATA DICTIONARY

4.1 MOSART Routines

The data dictionaries for the executable routines and BLOCK DATA for MOSART are given below.

Descriptions of all input variables, together with declarations of PARAMETERs, INTRINSIC and EXTERNAL routines, local variables, and COMMON blocks are provided.

REAL FUNCTION ABCCL4

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})
TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         INT
      EXTERNAL          XTERP,CROSBD
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              TMP(5)
```

COMMON Blocks: /CRSECT/

REAL FUNCTION ABHNO4

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})
TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         INT
      EXTERNAL          XTERP,CROSBD
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              TMP(5)
```

COMMON Blocks: /CRSECT/

REAL FUNCTION ABN2O5

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})
TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         INT
      EXTERNAL          XTERP,CROSBD
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              TMP(5)
```

COMMON Blocks: /CRSECT/

REAL FUNCTION ABSCFC

Argument Declarations:

```
V      - REAL Variable - Wavenumber (cm-1)
TEMP   - REAL Variable - Temperature (K)
INDCFC - INTEGER Variable - CFC index
           INDCFC = 1 implies CCl3F (CFC-11)
           INDCFC = 1 implies CCl2F2 (CFC-12)
           INDCFC = 1 implies CClF3 (CFC-13)
           INDCFC = 1 implies CF4 (CFC-14)
           INDCFC = 1 implies CHF2Cl (CFC-22)
           INDCFC = 1 implies C2Cl3F3 (CFC-113)
           INDCFC = 1 implies C2Cl2F4 (CFC-114)
           INDCFC = 1 implies C2ClF5 (CFC-115)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         INT
      EXTERNAL          XTERP,CFCBD
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              TMPCFC(5)
```

COMMON Blocks: /CFCBM/

REAL FUNCTION ABSCLO

Argument Declarations:

```
V      - REAL Variable - Wavenumber (cm-1)
TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         INT
      EXTERNAL          XTERP,CROSBD
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              TMP(5)
```

COMMON Blocks: /CRSECT/

REAL FUNCTION ABSH2O

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,INT,MIN
```

Local Variable Declarations:

```
      INTEGER           I,IP,NPTS
      REAL              CH2O(4),WL,WLX,FAC,WL1,WL2,DWL
```

COMMON Blocks: None

SUBROUTINE ABSMOL

Argument Declarations:

V - REAL Variable (Input) - Wavenumber (cm^{-1})
SDV - REAL Vector (Len = Unspecified) (Output) - Extinction coefficient (cm^{-1})
ODV - REAL Vector (Len = Unspecified) (Output) - Inverse line spacing (cm)
CDV - REAL Vector (Len = Unspecified) (Output) - Pressure-broadened continuum extinction coefficient (cm^{-1})
TDEPA - REAL Variable (Output) - Temperature-dependence exponent for line width
ALF - REAL Variable (Output) - Foreign-broadened line width at STP (cm^{-1})
RADFL0 - REAL Vector (Len = Unspecified) (Input) - Radiation field term for the band temperatures
PRTN0 - REAL Vector (Len = Unspecified) (Input) - Partition function for the band temperatures
NTEMP - INTEGER Variable (Output) - Number of temperature values
MOLEC - INTEGER Variable (Input) - Molecular index number

PARAMETER Declarations:

```
      INTEGER           NPMAX,NTMPMX,MOLMAX,MLIDMX
      PARAMETER         (NPMAX=250, NTMPMX=5, MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INT,ABS,REAL
      EXTERNAL          DEVCBD,UFTPBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           I,N,NREC,IOS,IBIN(NPMAX),IMOL(NPMAX),IP,IV,
                          IALF(NPMAX),NRECU
      REAL              VDUM(MOLMAX),SDZ(NTMPMX,NPMAX),
                          ODZ(NTMPMX,NPMAX)
```

COMMON Blocks: /CONSTN/,/DEVICE/,/MOLECP/,/UFTAPE/

REAL FUNCTION ABSN2

Argument Declarations:

```
V      - REAL Variable - Wavenumber (cm-1)
TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,INT,MIN,SQRT
```

Local Variable Declarations:

```
      INTEGER          I,IP,NPTS
      REAL             CN2(133),T0,TSS,VX,FAC,V1,V2,DV
```

COMMON Blocks: None

REAL FUNCTION ABSN2O

Argument Declarations:

```
V      - REAL Variable - Wavenumber (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,INT,MIN
```

Local Variable Declarations:

```
      INTEGER          I,IP,NPTS
      REAL             CN2O(7),WL,WLX,FAC,WL1,WL2,DWL
```

COMMON Blocks: None

REAL FUNCTION ABSNO2

Argument Declarations:

```
V      - REAL Variable - Wavenumber (cm-1)
```

PARAMETER Declarations:

```
      INTEGER          NMAX
      PARAMETER        (NMAX=7176)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        INT,REAL
      EXTERNAL         NO2BD
```

Local Variable Declarations:

```
      INTEGER          N
      REAL             XI,FAC
```

COMMON Blocks: /NO2XS/

SUBROUTINE ABSO2

Argument Declarations:

V	- REAL Variable (Input)	- Wavenumber (cm^{-1})
PRESS	- REAL Variable (Input)	- Pressure (mb)
TEMP	- REAL Variable (Input)	- Temperature (K)
SIGMA	- REAL Variable (Output)	- Absorption coefficient (cm^{-1} atm)
CONT	- REAL Variable (Output)	- Continuum absorption coefficient (cm^{-1} atm)
IBAND	- INTEGER Variable (Input/Output)	- Band model index
QA	- REAL Variable (Input/Output)	- LOWTRAN double exponential band model parameter

INTRINSIC and EXTERNAL Declarations:

REAL	XTERP
INTRINSIC	INT,MIN,REAL
EXTERNAL	XTERP,O2UVBD

Local Variable Declarations:

INTEGER	I,IP,ITRP1
REAL	P0,T0,DENUM,WL,TORRAT,SDV,APR,VX,FAC,PS,TS

COMMON Blocks: /HERZBG/,/SHURUN/

REAL FUNCTION ABSO3

Argument Declarations:

V	- REAL Variable	- Wavenumber (cm^{-1})
TEMP	- REAL Variable	- Temperature (K)

PARAMETER Declarations:

INTEGER	NMAX
PARAMETER	(NMAX=3080)

INTRINSIC and EXTERNAL Declarations:

INTRINSIC	MIN,REAL,INT
EXTERNAL	O3HHBD,O3CWBD

Local Variable Declarations:

INTEGER	I,IP
REAL	DT,VX,FAC,C0,C1,C2

COMMON Blocks: /O3CWB/,/O3HHB/

REAL FUNCTION ABSSO2

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})

PARAMETER Declarations:

```
      INTEGER          NMAX
      PARAMETER        (NMAX=5562)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        INT,REAL
      EXTERNAL         SO2BD
```

Local Variable Declarations:

```
      INTEGER          N
      REAL             XI,FAC
```

COMMON Blocks: /SO2XS/

SUBROUTINE AECALC

Argument Declarations:

HXTRA - REAL Vector (Len = Unspecified) (Input) - Extra altitudes in altitude grid
NXTRA - INTEGER Variable (Input) - Dimension of HXTRA
TITLE - CHARACTER*(*) Variable (Input) - Title in printout
HEADNG - CHARACTER*(*) Variable (Input) - Heading in printout

INTRINSIC and EXTERNAL Declarations:

```
      REAL             PLANCK
      INTRINSIC        REAL,MAX,MIN
      EXTERNAL         PLANCK
```

Local Variable Declarations:

```
      INTEGER          I,IM,IP
      REAL             ASUM,ESUM,TSOLAR,TTHRML,V,DV,A,E
```

COMMON Blocks: None

SUBROUTINE AERSOL

Argument Declarations:

```
  IAERO  - INTEGER Variable (Input) - Index for aerosol type
  RH     - REAL Variable (Input) - Relative humidity
  LAYER  - INTEGER Variable (Input) - Layer index
  VIS    - REAL Variable (Output) - Visible range (km)
             This is output for the Navy Marine aerosol model,
             IAERO = 4, and the Desert aerosol model, IAERO = 6.
  WIND   - REAL Variable (Input) - Current windspeed (m/sec)
  WHH    - REAL Variable (Input) - 24-hour average windspeed (m/sec)
  ICSTL  - INTEGER Variable (Input) - Coastal influence index
  TEMP   - REAL Variable (Input) - Temperature (K)
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,NWLAER,NWLCLD,NANG,NSTTMP
      PARAMETER        (MLMAX=140, NSTTMP=16)
      PARAMETER        (NWLAER=47, NWLCLD=79, NANG=65)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      INTRINSIC        MAX,MIN
      EXTERNAL         PROFAC,MARINE,ARSLBD,DESAER,BKSTBD,XTERP,
                         MIEPHS,ARSABD,ARSXBD
```

Local Variable Declarations:

```
      INTEGER          I,IAP,ITRP1,IMATRL
      REAL             BEXT(NWLAER),RHX,CXV,SUM
```

COMMON Blocks: /AEROSL/,/AERSCA/,/AERSLA/,/AERSLX/,/AERUSR/,
/BSTAER/

REAL FUNCTION AH2O2

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})

PARAMETER Declarations:

```
      INTEGER          NWL
      PARAMETER        (NWL=29)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      EXTERNAL         XTERP
```

Local Variable Declarations:

```
      INTEGER          ITRP
      REAL             XH2O2(NWL),XD2O2(NWL),WL(NWL),WL0,XLOSCH,
                         PH2O2
```

COMMON Blocks: None

REAL FUNCTION AIRTMP

Argument Declarations:

```
HOUR   - REAL Variable - Hour of the day (decimal time)
MONTH  - INTEGER Variable - Month of the year (JAN = 1)
TMIDN  - REAL Variable - Air temperature at midnight (K)
TNOON  - REAL Variable - Air temperature at noon (K)
HOUR0  - REAL Variable - Reference hour (decimal time)
TAIR0  - REAL Variable - Reference air temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          SIN,COS
```

Local Variable Declarations:

```
      REAL               B(12),THETA,DELT
```

COMMON Blocks: /CONSTN/

SUBROUTINE AMMNIA

Argument Declarations:

```
V      - REAL Variable (Input) - Wavenumber (cm-1)
SD     - REAL Variable (Output) - S/d (amagat-1 cm-1)
           Note:  SD still needs to be multiplied by the
             rotation and vibration partition function
OD     - REAL Variable (Output) - 1/d (cm)
CD     - REAL Variable (Output) - Line wings contribution (amagat-1 cm-1)
           Note:  CD still needs to be multiplied by the
             rotation and vibration partition function
ALF    - REAL Variable (Output) - Line width (cm-1)
IBAND  - INTEGER Variable (Output) - Band model index
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          INT,MIN
```

PARAMETER Declarations:

```
      INTEGER            NVMAX
      PARAMETER          (NVMAX=111)
```

Local Variable Declarations:

```
      INTEGER            IV
      REAL               SDV(NVMAX),ODV(NVMAX),ALFV,FAC,V1,V2,DV
```

COMMON Blocks: None

REAL FUNCTION AMOLSC

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  P      - REAL Variable - Pressure (mb)
  T      - REAL Variable - Temperature (K)
  WH2O   - REAL Variable - Water vapor mixing ratio (ppm)
  WCO2   - REAL Variable - Carbon dioxide mixing ratio (ppm)
  WO2    - REAL Variable - Oxygen mixing ratio (ppm)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              DEPOL
      DOUBLE PRECISION  REFRAC
      INTRINSIC         REAL,DPROD
      EXTERNAL          REFRAC
```

Local Variable Declarations:

```
      REAL              WL
      DOUBLE PRECISION  DUM,DPL,XN,AN0
```

COMMON Blocks: /CONSTN/

SUBROUTINE ASPECT

Argument Declarations:

```
  ISHINE - INTEGER Variable (Input) - Sky/Earthshine index
             Refer to User Reference Manual for definition.
  PHISH  - REAL Vector (Len = Unspecified) (Output) - Sky/Earthshine
             angles (deg)
  NASPCT - INTEGER Variable (Output) - Number of Sky/Earthshine angles
  LSRCE  - INTEGER Variable (Input) - Location of source altitude in
             altitude array
  LBKGD  - INTEGER Variable (Input) - Location of background altitude in
             altitude array
  XMH    - REAL Vector (Len = Unspecified) (Input) - Atmospheric
             refractivity as a function of altitude
  RE     - DOUBLE PRECISION Variable (Input) - Earth radius (km)
  HT     - REAL Variable (Input) - Source altitude (km)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NASMAX,ISMX,MOLMAX
      PARAMETER         (MLMAX=140, NASMAX=15)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DBLE,ACOS,ABS
      EXTERNAL          GETGLC
```

Local Variable Declarations:

```
      INTEGER           K,M,ICHK,KASPCT(15)
      REAL              DPHI,PHI0,PHIHOR,PHIX,A,B
      DOUBLE PRECISION  HORA,XMU(5),WT(5)
```

COMMON Blocks: /CONSTN/,/USERDF/

SUBROUTINE ATMPRN

Argument Declarations:

```
  IFLTR  - INTEGER Variable (Input) - Index for filter response
             IFLTR = 0 implies a square wave response
             IFLTR = 1 implies a user-defined response
  TFLTR  - CHARACTER*(*) Variable (Input) - Title for user-defined filter
  HEADNG - CHARACTER*(*) Variable (Input) - User-defined heading
  TITLE  - CHARACTER*(*) Variable (Input) - Title
  BW     - REAL Variable (Input) - Bandwidth (cm-1)
  BWL    - REAL Variable (Input) - Bandwidth (μm)
  IGEOM  - INTEGER Variable (Input) - Geometry number
  IV     - INTEGER Variable (Input) - Spectral interval number
  ISMARY - INTEGER Variable (Input) - Summary switch
```

PARAMETER Declarations:

```
      INTEGER           NGMAX,NAZMAX,NASMAX,NZSMAX,NMATL,NSCEN,MAXLAT,
                          MAXLON,NL,ISMX,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NMATL=28, NSCEN=35, NVSMAX=20)
      PARAMETER         (MAXLAT=3, MAXLON=1, NL=50)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RELHUM
      CHARACTER*72      IOERR
      INTRINSIC         REAL,DBLE,SQRT,COS,SIN
      EXTERNAL          DEVCBD,RELHUM,CHRCBD,PRALT,SETBCK,
                          INDXBK,IOERR,ATMSBD,BKGDBD,SCENBD
```

Local Variable Declarations:

```
      INTEGER           I,K,M,MM,IOS,JT,IERR,ITYPE0,ITYPE1,KSCENE
      REAL              WL1,WL2,RHW(NAZMAX),RHI(NAZMAX),ALTPR(NAZMAX),
                          TAIRP,FRSNWP,CLDCVP(0:3),TERR,TMIDNP,TNOONP,
                          FRICEP, FRWTRP
      DOUBLE PRECISION  RE
      CHARACTER*24      TFLTR0,TFLTRX
      LOGICAL           FLBK

COMMON Blocks:          /ATMDAT/,/BACKGD/,/CHRCNM/,/CONSTN/,/DEVICE/,
                          /FLAGS/,/HEADER/,/INTSTO/ ,/OUTPUT/,/SCENES/
```

DOUBLE PRECISION FUNCTION BAND

Argument Declarations:

```
  XSTAR  - DOUBLE PRECISION Variable - Weak line optical depth
  S1     - REAL Variable - Summing variable for Lorentz halfwidth
             times line density
  S2     - REAL Variable - Summing variable for Doppler halfwidth
             times line density
  S3     - REAL Variable - Summing variable for line density
  S6     - REAL Variable - Summing variable for (Lorentz halfwidth)^2
             times line density
  QA     - REAL Variable - Exponential parameter for LOWTRAN model
  DV     - REAL Variable - Wavenumber increment (cm^-1)
  IBAND  - INTEGER Variable - Index for band model
             IBAND = 0 for exponential band model
             IBAND = 1 for Voight band model
             IBAND = 2 for LOWTRAN double exponential model
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX,MLIDMX
      PARAMETER         (MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      DOUBLE PRECISION DERF
      INTRINSIC        MAX,MIN,REAL,SQRT,LOG,ABS,DBLE,EXP,LOG10
      EXTERNAL         DERF
```

Local Variable Declarations:

```
      INTEGER          IEXP
      REAL             ANLINE,EXMIN
      DOUBLE PRECISION ACBAR,ADBAR,ODBAR,XS,TXP,WS,QAWS,WL,WD,DUM,U23
                         AC2BAR,RHO,F1,F2,F3,XSTARP,WSL,U0,U2,RATIO
      DOUBLE PRECISION STORE,WL,WD,U0
```

COMMON Blocks: /CONSTN/,/MOLECP/

SUBROUTINE BBARSL

Argument Declarations:

ARSLAS - REAL Vector (Len = Unspecified) (Output) - Aerosol absorption for the solar region (km^{-1})
ARSLSS - REAL Vector (Len = Unspecified) (Output) - Aerosol scattering for the solar region (km^{-1})
ARSLAT - REAL Vector (Len = Unspecified) (Output) - Aerosol absorption for the thermal region (km^{-1})
ARSLST - REAL Vector (Len = Unspecified) (Output) - Aerosol scattering for the thermal region (km^{-1})
ZP - REAL Vector (Len = Unspecified) (Output) - Altitude array for multiple scattering calculation (m)
KK - INTEGER Variable (Input) - Latitude index
LL - INTEGER Variable (Input) - Longitude index

PARAMETER Declarations:

```
INTEGER          MLMAX,NWLAER,NWLCLD,NANG,NGMAX,MAXLAT,MAXLON,
                   ISMX,MOLMAX,MLIDMX
PARAMETER        (MLMAX=140, NGMAX=15, MAXLAT=3, MAXLON=1)
PARAMETER        (NWLAER=47, NWLCLD=79, NANG=65)
PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
REAL             PLANCK,XTERP
EXTERNAL         PLANCK,XTERP,ARSLBD
```

Local Variable Declarations:

```
INTEGER          I,L,LZ
REAL             TMPSLR,TMPTML,SUMS,SUMT,V,DV,PLTML,PLSLR,
                   A,S,WZ,DUMA(101),DUMAP(101),DUMS(101),
                   DUMSP(101),DUMW(101),ZKM
```

COMMON Blocks: /AEROSL/, /AERSCA/,/INITAL/,/MOLECP/

REAL FUNCTION BBO3

Argument Declarations:

X - REAL Variable - Ozone concentration (atm-cm STP)

SUBROUTINE BCKCHK

Argument Declarations:

ITERM - INTEGER Variable (Input/Output) - Background index.
Refer to User Reference manual for definition.
SCTNGS - REAL Variable (Input) - Solar scattering angle (deg)
SCTNGS = 0.0 implies looking directly into the sun
SCTNGL - REAL Variable (Input) - Lunar scattering angle (deg)
SCTNGL = 0.0 implies looking directly into the moon

PARAMETER Declarations:

```
      INTEGER          NGMAX
      PARAMETER        (NGMAX=15)
```

COMMON Blocks: /FLAGS/

SUBROUTINE BCKGND

Argument Declarations:

ITYPE - INTEGER Variable (Input) - Type of background
V - REAL Variable (Input) - Wavenumber (cm^{-1})
DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})
RADEM - REAL Variable (Output) - Emitted background radiance ($W/cm^2/sr/cm^{-1}$)
RADRF - REAL Variable (Output) - Reflected background radiance ($W/cm^2/sr/cm^{-1}$)
RADSD - REAL Variable (Output) - Standard deviation of the background radiance ($W/cm^2/sr/cm^{-1}$)
XLGAL - REAL Variable (Input) - Galactic azimuth (deg)
BGAL - REAL Variable (Input) - Galactic elevation (deg)
XLECL - REAL Variable (Input) - Ecliptic azimuth (deg)
BECL - REAL Variable (Input) - Ecliptic elevation (deg)
HSKYSH - REAL Variable (Input) - Spectral, spatially integrated emitted skyshine ($W/cm^2/cm^{-1}$)
HSCATT - REAL Variable (Input) - Spectral, spatially integrated scattered solar skyshine ($W/cm^2/cm^{-1}$)
HSOLAR - REAL Variable (Input) - Spectral solar irradiance ($W/cm^2/cm^{-1}$)
PROJS - REAL Vector (Len = Unspecified) (Input) - Projection of solar irradiance on oriented surfaces
SHDWS - REAL Variable (Input) - Solar self-shadowing factor
HLUNAR - REAL Variable (Input) - Spectral lunar irradiance ($W/cm^2/cm^{-1}$)
PROJL - REAL Vector (Len = Unspecified) (Input) - Projection of lunar irradiance on oriented surfaces
SHDWL - REAL Variable (Input) - Lunar self-shadowing factor
TAU - REAL Variable (Input) - Transmittance observer-background
PHIIS - REAL Variable (Input) - Elevation angle of incident solar radiation (deg)
PHIIL - REAL Variable (Input) - Elevation angle of incident lunar radiation (deg)
PHIRF - REAL Variable (Input) - Elevation angle of reflected line of sight at the background (deg)
AZOBS - REAL Variable (Input) - Observer azimuthal angle (deg)
AZSOL - REAL Variable (Input) - Azimuthal angle between incident solar and reflected lines-of-sight (deg)
AZLUN - REAL Variable (Input) - Azimuthal angle between incident lunar and reflected lines-of-sight (deg)
BCKSUM - REAL Array (Dim = 6 x Unspecified) (Input/Output) - Background material radiances ($W/cm^2/sr/cm^{-1}$)
CC - REAL Variable (Input) - Fractional cloud cover
BCKFAC - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Background temperature proportionality factor
NPTH - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits for non-zero elements of BCKFAC
FRSNW - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Percentage snow (%)
FRICE - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Percentage ice (%)
FRWTR - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Percentage water (%)

PARAMETER Declarations:

```
INTEGER          NGMAX,NAZMAX,NASMAX,NZSMAX,NMATL,MAXLAT,MAXLON,
                   ISMX,NVSMAX,MOLMAX
PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
PARAMETER        (NMATL=28, NVSMAX=20)
PARAMETER        (MAXLAT=3, MAXLON=1, MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP,SOLAR,GALRAD,PLANCK,STARAD,ZODICL,EXGALS,
                          SLUNAR,BDRF
      COMPLEX           INDEXW,INDEXI,EMTREF,REFEST
      INTRINSIC         SQRT,REAL,DBLE,DPROD,ABS,SIN,COS
      EXTERNAL          XTERP,SOLAR,GALRAD,PLANCK,STARAD,ZODICL,EXGALS,
                          BKGDBD,SLUNAR,FRESNL,BDRF,INDEXW,INDEXI,
                          EMTREF,SETBCK,REFEST,DEMSXX
```

Local Variable Declarations:

```
      INTEGER           I,K,M,NDX,KK,LL,IGRND,ITRP0,NINCL,IRGH0,IRGH1
      REAL              OMEG,WL0,REFLS,REFLL,REFLD,EMIS,PLK,XNORM(6,3),
                          REFLX,TMPNDX(6),EMV,EMH,EMV1,EMH1,EMVF,EMHF,
                          SLOPE,FOAMT,WVHT,TMPLYR(0:3),TAIRND,UOBS(3),
                          USOL(3),ULUN(3),POBS,PSOL,PLUN,XOBS,XSOL,XLUN
      DOUBLE PRECISION  EM,EMI,RF,RFI,RTERS(6),RTERL(6),RTERD,VARNC,
                          DUMF,SDVM,DUMR,FRSLP(6)
      COMPLEX           DIELEC,XMUC,INAIR(2),INICE,INMAT,REFR,EPSX,RH,
                          RV,TV,TH,EPSA
```

COMMON Blocks: /BACKGD/,/CONSTN/,/HEADER/

SUBROUTINE BCKPRN

Argument Declarations:

```
  IFLTR  - INTEGER Variable (Input) - Index for filter response
             IFLTR = 0 implies a square wave response
             IFLTR = 1 implies a user-defined response
  TFLTR  - CHARACTER*(*) Variable (Input) - Title for user-defined filter
  HEADBK - CHARACTER*(*) Variable (Input) - User-defined heading
  TITLE  - CHARACTER*(*) Variable (Input) - Title
  BW     - REAL Variable (Input) - Bandwidth (cm-1)
  BWL    - REAL Variable (Input) - Bandwidth (µm)
  IGEOM  - INTEGER Variable (Input) - Geometry number
  IV     - INTEGER Variable (Input) - Spectral set number
  FLBCKZ - LOGICAL Variable (Input) - Flag for existence of background
             parameters
```

PARAMETER Declarations:

```
      INTEGER           NGMAX,NAZMAX,NASMAX,MLMAX,NZSMAX,MAXLAT,
                         MAXLON,NL,ISMX,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NL=50, NVSMAX=20)
      PARAMETER         (MAXLAT=3, MAXLON=1, MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         REAL,DBLE,SQRT,COS,SIN
      EXTERNAL          DEVCBD,IOERR,ATMSBD
```

Local Variable Declarations:

```
      INTEGER           MM,LB,IOS
      REAL              WL1,WL2
      DOUBLE PRECISION  RE
      CHARACTER*24      TFLTR0,TFLTRX
```

```
COMMON Blocks:          /ATMDAT/,/BCKDAT/,/CONSTN/,/DEVICE/,/FLAGS/,
                          /HEADER/,/OUTPUT/
```

REAL FUNCTION BDRF

Argument Declarations:

```
  PHII   - REAL Variable - Incident elevation angle (deg)
  PHIR   - REAL Variable - Reflected elevation angle (deg)
  AZIM   - REAL Variable - Azimuth (deg)
  WL     - REAL Variable - Wavelength (μm)
  DELH   - REAL Variable - Standard deviation of surface roughness (m)
  CORREL - REAL Variable - Correlation length of surface roughness (m)
  ITYPE  - INTEGER Variable - Roughness type
             ITYPE = 1 implies Gaussian roughness
             Otherwise, exponential roughness
  DIELEC - COMPLEX Variable - Permittivity (dielectric constant and
             conductivity) of surface
  XMUC   - COMPLEX Variable - Permeability of surface
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SHADOW
      COMPLEX           DIREFL
      INTRINSIC         MIN,EXP,SIN,COS,CMPLX,ABS,REAL,AIMAG,DBLE,SQRT,
                          MAX
      EXTERNAL          DIREFL,SHADOW
```

Local Variable Declarations:

```
      INTEGER           IPOLR1,IPOLR2
      REAL              SIGMA(2,2),SNC,XKC,XKH,SN3,XI,SLOPE,DTPRD,XJ,
                          AZIMP
      DOUBLE PRECISION THETAI,THETAR,PHI,CS1,SN1,CS2,SN2,CST,SNT,A1,
                          A2,A3,A4,EX,EY,EZ,EXY,EXYZ,ETEMP,TMP3
      COMPLEX           DEN1,DEN2,DEN3,DEN4,XS1,XS2,DIEFAC,XMUFAC,
                          RHOF(2)
```

COMMON Blocks: /CONSTN/

SUBROUTINE BEAUFT

Argument Declarations:

```
  WIND   - REAL Variable (Input) - Wind speed at 10 m (m/sec)
             Note:  10 m height per Resolution 9, International
                    Meteorological Committee, Paris, 1946
  WAVEHT - REAL Variable (Output) - Wave height (m)
  SLOPE  - REAL Variable (Output) - RMS wave slope
  FOAM   - REAL Variable (Output) - Fraction of foam
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         AINT,MAX,MIN,SQRT
```

Local Variable Declarations:

```
      INTEGER           I,IBFRT
      REAL              WINDMN(0:17)
      REAL              WNDMAX(0:17),WNDMIN(0:17),
                          HTMIN(0:17),HTMAX(0:17),WNDSPD,FAC,
                          WINDCM(3,2),SLOPCM(3,2)
```

COMMON Blocks: None

REAL FUNCTION BETA

Argument Declarations:

```
  ASYM   - REAL Variable - Phase function asymmetry factor
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,ABS,SQRT,MAX,MIN,DBLE
```

Local Variable Declarations:

```
      INTEGER           I,J
      REAL              GJ,A(1000),SUM,DSUM,G,A0,G2,XBETA
CHG   REAL              AHG(60)
```

COMMON Blocks: /CONSTN/

REAL FUNCTION BETAU

Argument Declarations:

```
  XMU0   - REAL Variable - Cosine of the zenith angle
  ASYM   - REAL Variable - Phase function asymmetry factor
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS,REAL,MAX,MIN,SQRT
```

Local Variable Declarations:

```
      INTEGER           I,J,JP
      REAL              PJM,PJ,G2,AU(3,1000),GJ(3),SUM,DSUM,A0,G
```

COMMON Blocks: /CONSTN/

SUBROUTINE BINFIL

Argument Declarations:

```
  IFINP  - INTEGER Variable (Input/Output) - Input file number
  IFATM  - INTEGER Variable (Input/Output) - Atmosphere/source file number
  IFBCK  - INTEGER Variable (Input/Output) - Background file number
  IFPLM  - INTEGER Variable (Input/Output) - Plume file number
  IFMSC  - INTEGER Variable (Input/Output) - Multiple scatter file number
  IFTRN  - INTEGER Variable (Input/Output) - Component transmission file
             number
  IFHTR  - INTEGER Variable (Input/Output) - Heat transfer file number
  IFTP7  - INTEGER Variable (Input/Output) - MODTRAN TAPE7 file number
  IFTP7  - INTEGER Variable (Input/Output) - MODTRAN TAPE8 file number
  IFDIS  - INTEGER Variable (Input/Output) - DIS data base file number
  FILENM - CHARACTER*(*) Vector (Len = Unspecified) - File names
  ISMARY - INTEGER Variable (Output) - File summary switch
```

PARAMETER Declarations:

```
      INTEGER           NGMAX
      PARAMETER         (NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*1       UPCASE
      CHARACTER*72      IOERR
      EXTERNAL          RDLINE,FLSTAT,UPCASE,CHKRST,IOERR,CHKVER,DISEND
```

Local Variable Declarations:

```
      INTEGER           IOS,NDUM1,NDUM2,NDUM3,ISMP
      LOGICAL           FILXST,FILXSB,FILXSP,FILXSM,FILXSC,FILXSH,
                          FILXS7,FILXS8,LDUM
      CHARACTER*1       YES
      CHARACTER*3       STAT(2)
      CHARACTER*40      HEADNG,HEADNB
      CHARACTER*80      TITLE,TITLB
      CHARACTER*255     VARIAB
```

COMMON Blocks: /FLAGS/,/RSTART/

SUBROUTINE BMOD

Argument Declarations:

V - REAL Variable (Input) - Wavenumber (cm^{-1})
DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})
NLAT - INTEGER Variable (Input) - Number of latitudes
NLON - INTEGER Variable (Input) - Number of longitudes

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,MAXTMP,MAXLAT,MAXLON,NGMAX,MOLMAX,
                          MLIDMX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8,
                          MAXTMP=5)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RADFLD,PARTIT,ABSN2,ABSH2O,ABSN2O,ABSNO2,
                          ABSSO2,ABSO3,O2CNT,AH2O2,ABSCFC,ABCCL4,
                          ABHNO4,ABN2O5,ABSCLO
      LOGICAL           EVEN
      INTRINSIC         SQRT,ABS,REAL,INT,MIN
      EXTERNAL          PROFAC,MOLPBD,EVEN,RADFLD,ABSMOL,PARTIT,
                         ABSNO2,ABSN2,ABSO3,H2OCNT,O2CNT,ABSO2,ABSH2O,
                         ABSN2O,ABSSO2,AH2O2,AMMNIA,ABSCFC,ABCCL4,
                         ABHNO4,ABN2O5,ABSCLO
```

Local Variable Declarations:

```
      INTEGER           K,L,N,KEYML(MLMAX,MAXLAT,MAXLON),KK,LL,NDV,
                          KEYMLP(MLMAX,MAXLAT,MAXLON),ISWX,MLOLD,NTEMP,
                          IV,KEY,KEYP
      REAL              SD2(ISMX,MLMAX,MAXLAT,MAXLON),SDV(MAXTMP),
                          ODV(MAXTMP),T0,V0,SUM,VP,WT,CDV(MAXTMP),
                          TBAND(MAXTMP),RADFL(MLMAX,MAXLAT,MAXLON),
                          AD0(ISMX),FAC(MLMAX,MAXLAT,MAXLON),ALF,
                          TS(MLMAX,MAXLAT,MAXLON),TDEPA,
                          PRTN0(MAXTMP,ISMX),TSS(MLMAX,MAXLAT,MAXLON),
                          RADFL0(ISMX),ODAV(ISMX,MLMAX,MAXLAT,MAXLON),
                          SDX,ODX,CDSX,CDX,PS,P0,HERZ,CDX25,CDSX25
      LOGICAL           EVN
```

```
COMMON Blocks:          /CONSTN/,/INITAL/,/MOLCON/,/MOLDAT/,/MOLECP/,
                          /PRBNDA/,/PRBNDB/
```

SUBROUTINE BNDMLG

Argument Declarations:

```
  MOLEC  - INTEGER Variable (Input) - Molecular index
             1 - Water vapor
             2 - Carbon dioxide
             3 - Ozone
             4 - Nitrogen oxide
             5 - Carbon monoxide
             6 - Methane
  TEMP   - REAL Variable (Input) - Temperature (K)
  F      - REAL Vector (Len = Unspecified) (Output) - Line strength
             partition function
  G      - REAL Variable (Output) - Fine structure partition function
  NNN    - INTEGER Variable (Input) - DIMENSION of F
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SQRT,EXP
```

Local Variable Declarations:

```
      INTEGER           K
      REAL              TH(MOLMAX),ETHTL,ETHKTL,FN,SUM,SUM1
```

COMMON Blocks: None

SUBROUTINE BNDPAR

Argument Declarations:

```
  V       - REAL Variable (Input) - Wavenumber (cm-1)
  DV      - REAL Variable (Input) - Wavenumber increment (cm-1)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,NAZMAX,NASMAX,NGMAX,NZSMAX,NWLAER,
                          NWLCLD,NANG,MAXLAT,MAXLON,NVSMAX,MOLMAX,
                          MLIDMX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IBNSRC
      REAL              AMOLSC,XTERP,PHMLSC
      EXTERNAL          AMOLSC,XTERP,PHFUNC,ARSLBD,BMOD,RAINSP,SNOWSP,
                          IBNSRC,OPNSCR,MOLPBD,PHMLSC
CMMW  EXTERNAL          MMWPAR
```

Local Variable Declarations:

```
      INTEGER           I,L,K,JICE,JCIRUS,KK,LL,ITRP
      REAL              P0,T0,WL,RNABS,RNSCT,SNABS,SNSCT,PS,TS,SDT,DUM,
                          CDT,SCPHM,SCPHX,FPIINV,PHASEM(NANG)

COMMON Blocks:        /AEROSL/,/AERSCA/,/AERSCC/,/ARSLSC/,/CGWTS/,
                        /CLDUSR/,/CONSTN/,/HEADER/,/INITAL/,/LOWMSC/,
                        /MOLCON/,/MOLECP/,/PRBNDA/,/PRBNDB/
```

SUBROUTINE BNTPTH

Argument Declarations:

XS	- DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Optical depth
S1	- REAL Vector (Len = Unspecified) (Input) - Summing variable for Lorentz halfwidth times line density.
S2	- REAL Vector (Len = Unspecified) (Input) - Summing variable for Doppler halfwidth times line density.
S3	- REAL Vector (Len = Unspecified) (Input) - Summing variable for line density
S4	- REAL Vector (Len = Unspecified) (Input) - Summing variable for continuum
S5	- REAL Vector (Len = Unspecified) (Input) - Summing variable for scattering
S6	- REAL Vector (Len = Unspecified) (Input) - Summing variable for (Lorentz halfwidth)^2 times line density.
XSS	- DOUBLE PRECISION Vector (Len = Unspecified) (Output) - Initial values of optical depth for new path
S1S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S1 for new path
S2S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S2 for new path
S3S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S3 for new path
S4S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S4 for new path
S5S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S5 for new path
S6S	- REAL Vector (Len = Unspecified) (Output) - Initial values of S6 for new path
N	- INTEGER Variable (Input) - Number of species

Local Variable Declarations:

```
      INTEGER          K
```

COMMON Blocks: None

SUBROUTINE BRBNDR

Argument Declarations:

```
  TMIDN  - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Temperature at
           midnight (K)
  TNOON  - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Temperature at
           noon (K)
  INITV  - INTEGER Variable (Input) - Restart spectral index
  HEADNG - CHARACTER*(*) Variable (Input) - Header
  TITLE  - CHARACTER*(*) Variable (Input) - Title
  MTIME  - INTEGER Variable (Output) - Number of temporal values
```

PARAMETER Declarations:

```
      INTEGER          NGMAX,NAZMAX,NASMAX,NZSMAX,NMATL,NL,NSCEN,
                         NTIME,MLMAX,ISMX,NANTMX,NLAYER,MAXLAT,MAXLON,
                         NVSMAX,MOLMAX,MLIDMX
      PARAMETER        (NMATL=28, NSCEN=35)
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (NTIME=97, MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (NANTMX=25, NLAYER=20)
      PARAMETER        (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER        (NL=50, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             SLRCNT,XTERP,AIRTMP,SATUR,SEATMP
      CHARACTER*72     IOERR
      INTRINSIC        SIN,MAX,MIN,REAL,ABS,COS,SQRT,MOD
      EXTERNAL         SLRCNT,PRETEM,OPATH,FLUXLW,SOLBND,IOERR,BBARSL,
                         AIRTMP,EPHEMS,HTBLNC,XTERP,DEVCBD,CHRCBD,
                         SATUR,BKGDBD,SPCLYR,SEATMP,ATMSBD,MOLPBD
```

Local Variable Declarations:

```
      INTEGER          I,K,L,M,IM,MTL,ITM,NSTAB,IOS,KK,LL,IG,NDAYS,
                         JTIME,ITRP0,ITRP6,ITYPE,MTLP,LL0
      REAL             ZP(101),UP(101),VP(101),WP(101),ALBS,EMRAD,
                         DELTIM,RFDS(NTIME,6,NMATL),
                         DCTIME,SOLDIX,YLUNAZ,YLUNEV,U0,
                         YLUNDS,PHLUNY,LTEMP(NTIME),TSRF(NTIME),
                         FO,SIGMA,CC,T4,T1,T2,TAIRLC(NTIME),STABRS,
                         XLATS,XLONS,XLATL,XLONL,DT24,DUM,
                         WINDT(NTIME),PAIRLC(NTIME),CH2OLC(NTIME),
                         CLCVT(3,NTIME),CLBST(3,NTIME),CLTPT(3,NTIME),
                         AHRN(NANTMX),RHT,SLRCX,TLAYER(0:NLAYER+1),
                         DTMAX,SPHLYR(0:NLAYER+1),DENLYR(0:NLAYER+1),
                         HTCLYR(0:NLAYER+1),ZLAYER(0:NLAYER+1),TSSL,
                         DUMLYR(2,NLAYER+1),ARSLAS(101),ARSLSS(101),
                         ARSLAT(101),ARSLST(101),XNORM(6,3),SATURL,
                         SOLTIM,SOLAZL,SOLEVL
      LOGICAL          FLINI
```

```
COMMON Blocks:         /ANTECD/,/ATMDAT/,/BACKGD/,/BRBNDT/,/CHRCNM/,
                         /CONSTN/,/DEVICE/,/HEADER/,/INITAL/,/MOLCON/,
                         /OUTPUT/
```

SUBROUTINE CALCUL

Argument Declarations:

```
  ISHINE - INTEGER Vector (Len = Unspecified) (Input) - Sky/earthshine
             index for source.
             Refer to the User Reference Manual for definition.
  LENP   - INTEGER Vector (Len = Unspecified) (Input) - Path length
             index
             LENP(I) = 0 implies the short path
             LENP(I) = 1 implies the long path, if any ambiguity exists
  HEADNG - CHARACTER*(*) Variable (Input) - User-defined heading
  TITLE  - CHARACTER*(*) Variable (Input) - Title, including version
             number, date, and time of file generations
  FILERT - CHARACTER*(*) Variable (Input) - File root
  IFLTR  - INTEGER Variable (Input) - Filter index
  TFLTR  - CHARACTER*(*) Variable - Filter name
  ISMARY - INTEGER Variable (Input) - Summary index
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,MLMAX,ISMX,NGMAX,NZSMAX,MAXLAT,
                          MAXLON,NL,MLMX2,NVSMAX,ISTMAX,MOLMAX,NTIME
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NL=50, NVSMAX=20)
      PARAMETER         (ISTMAX=30000, NTIME=97)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL
      CHARACTER*72      IOERR
      EXTERNAL          PRCALC,SCNRIO,OPNSCR,DEVCBD,SUMFIL,SETBCK,
                          INDXBK,BRBNDR,SRCFLX,PUTHDR,RESOLV,IOERR,
                          SRCIRR,ATMSBD,SRCGEO
```

Local Variable Declarations:

```
      INTEGER           I,L,INITGM,INITV,IOS,ISCENE,IV,KK,LL,IFSCRP,
                          JSCENE,ISWOLD,ITYP1,IERR,IP,IGEOM,MM,INITVS,
                          NSLTOT,NLNTOT,ISWATM(MAXLAT,MAXLON),ITM,
                          KKK,LLL,JX,KX,KL,MTIME
      REAL              TMIDN(MAXLAT,MAXLON),TNOON(MAXLAT,MAXLON),DV,
                          TAIRP,CLDCVP(0:3),TMIDNP,TNOONP,FRSNWP,
                          RSOLAR,RLUNAR,YLAT,YLON,FRWTRP,FRICEP
      LOGICAL           FLOLD,FLSHN

COMMON Blocks:          /ATMDAT/,/BRBNDT/,/DEVICE/,/FLAGS/,/HEADER/,
                          /INITAL/,/PATH1/ ,/PATH1A/,/PATH4/ ,/PATH5A/,
                          /PATH5B/,/PATH5C/,/PATH5D/,/PATH6/ ,/PATH8/ ,
                          /RSTART/
```

SUBROUTINE CALEND

Argument Declarations:

```
  IDAY   - INTEGER Variable (Input/Output) - Day of the month
  IMONTH - INTEGER Variable (Input/Output) - Month of the year
  IYEAR  - INTEGER Variable (Input/Output) - Year
  IDAYX  - INTEGER Variable (Input/Output) - Day of the year
  YEAR   - REAL Variable (Output) - Decimal year
  ITYPE  - INTEGER Variable (Input) - Switch
             ITYPE = 0 implies day/month/year input
             ITYPE = 1 implies day of year input
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL
```

Local Variable Declarations:

```
      INTEGER          IDYMN(13,2),LPYR,IYR4,IYR100,IYR400,I
```

COMMON Blocks: None

SUBROUTINE CHANGE

Argument Declarations:

```
  CMOL   - REAL Vector (Len = Unspecified) (Input/Output) - Molecular
             concentrations (ppmv)
  CMOL0  - REAL Vector (Len = Unspecified) (Input) - Molecular
             concentrations at surface (ppmv)
  MONTH  - INTEGER Variable (Input) - Month of year
  IYEAR  - INTEGER Variable (Input) - Year
  XLAT   - REAL Variable (Input) - Latitude (deg)
```

PARAMETER Declarations:

```
      INTEGER          NVAR6,NYR1,NYR2
      PARAMETER        (NVAR6=6, NYR1=44, NYR2=258)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      INTRINSIC        REAL
      EXTERNAL         XTERP
```

Local Variable Declarations:

```
      INTEGER          I,ITRP1
      REAL             YR(NVAR6),CO2(NVAR6),N2O(NVAR6),CH4(NVAR6),
                         CMOL2,CMOL4,CMOL6,YEAR,CMOL5,CO,YEAR1(NYR1),
                         CO2X1(NYR1),YEAR2(NYR2),CO2X2(NYR2)
```

COMMON Blocks: None

SUBROUTINE CHKRST

Argument Declarations:

```
  NFILE  - INTEGER Variable (Input) - File unit number
  RESTRT - LOGICAL Variable (Output) - Restart flag
  NGEOM  - INTEGER Variable (Output) - Geometry index for restart
  NREC   - INTEGER Variable (Output) - Spectral record index for restart
  NRECS  - INTEGER Variable (Output) - Spectral subset index for restart
```

PARAMETER Declarations:

```
      INTEGER           NVSMAX,NGMAX
      PARAMETER         (NVSMAX=20, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         MAX
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           NHDR(2),IH,NG,IG,NVAR(NGMAX),IV,IVX,IOS,NVSET,
                          IGEOM,NV(NVSMAX),IFILE,IVS,IHDR(2000)
      REAL              HDR(2500),VAR(10000)
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE
```

COMMON Blocks: None

SUBROUTINE CHKVER

Argument Declarations:

```
  NFILE  - INTEGER Variable (Input/Output) - Device unit number
  FILXST - LOGICAL Variable (Input/Output) - Flag for existence of file
  HEADNG - CHARACTER*(*) Variable (Input) - Heading for reference
  TITLE  - CHARACTER*(*) Variable (Input) - Title for reference
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           IOS
      CHARACTER*40      HEADNX
      CHARACTER*80      TITLX
```

COMMON Blocks: None

SUBROUTINE CHTIME

Argument Declarations:

```
  TIME   - REAL Variable (Input/Output) - Decimal time (hours)
  IHR    - INTEGER Variable (Input/Output) - Hours (hours)
  IMN    - INTEGER Variable (Input/Output) - Minutes (min)
             Value is between 0 and 59.
  SEC    - REAL Variable (Input/Output) - Seconds (sec)
  ITYPE  - INTEGER Variable (Input) - Conversion index
             ITYPE = 0 implies decimal to Hr, Min, Sec
             Otherwise Hr, Min, Sec to decimal.
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          REAL,INT
```

Local Variable Declarations:

```
      REAL               XMIN
```

COMMON Blocks: None

REAL FUNCTION CIREX

Argument Declarations:

```
  TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          ABS,EXP,DBLE,REAL,MAX,MIN,SQRT
```

Local Variables

```
      INTEGER            I
      REAL               D0,SIGMAE,SQ3,DIAM(5),WIDTH(5),DL(5)
      DOUBLE PRECISION   SIZEN,FN100,FN1000,TC,FIWC,B1,B2
```

COMMON Blocks: None

SUBROUTINE CIRRUS

Argument Declarations:

```
  ICIRUS - INTEGER Variable (Input) - Cirrus cloud index
             ICIRUS = 0 implies no cirrus clouds
             ICIRUS = 1 implies standard cirrus clouds
             ICIRUS = 2 implies subvisual cirrus clouds
             ICIRUS = 3 implies a Heymsfield cirrus cloud model
  CIRBS  - REAL Variable (Input/Output) - Cirrus base altitude (km)
  CIRTHK - REAL Variable (Input/Output) - Cirrus thickness (km)
  CIREXT - REAL Variable (Input) - Extinction at 0.55 μm (km^-1)
  CIRICE - REAL Variable (Input/Output) - Ice concentration (gm/m^3)
  ITYPE  - INTEGER Variable (Input) - Latitude index
  ISEASN - INTEGER Variable (Input) - Season index
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MIN
```

Local Variable Declarations:

```
      INTEGER          ISN,I
      REAL             CAMEAN(10,2)
```

COMMON Blocks: None

SUBROUTINE CITIES

Argument Declarations:

```
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLON   - REAL Variable (Input) - Longitude (deg)
  FLURB  - LOGICAL Variable (Output) - Flag for an urban area
  URBNAM - CHARACTER*(*) Variable (Output) - Name of urban area
```

PARAMETER Declarations:

```
      INTEGER          NCITY
      PARAMETER        (NCITY=289)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX,MIN,INT,LEN,ABS
```

Local Variable Declarations:

```
      INTEGER          I,NLN,IURB(NCITY),LNDX(181),ILAT,ILATM
      REAL             CLAT(NCITY),CLON(NCITY),DLAT(5),DLON(5),YLON
      CHARACTER*34     CITYNM(NCITY),BLANKS
```

COMMON Blocks: None

SUBROUTINE CLDALT

Argument Declarations:

```
  Z      - REAL Vector (Len = Unspecified) (Input) - Altitude profile (km)
  T      - REAL Vector (Len = Unspecified) (Input) - Temperature profile (K)
  NTRPAU - INTEGER Variable (Input) - Position of tropopause in profile
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLONG  - REAL Variable (Input) - Longitude (deg)
  MONTH  - INTEGER Variable (Input) - Month of year
  HOUR   - REAL Variable (Input) - Time of day (dec. hours LST)
  HB     - REAL Variable (Input) - Terrain altitude (km)
  CLALTB - REAL Vector (Len = Unspecified) (Input/Output) - Cloud base
             altitude (km)
  CLALTT - REAL Vector (Len = Unspecified) (Input/Output) - Cloud top
             altitude (km)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              TMPCLD
      INTRINSIC         MAX,MIN,ABS,SIGN
      EXTERNAL          TMPCLD,RDGBL
```

Local Variable Declarations:

```
      INTEGER           M,KL,KLX
      REAL              TEMP,CLHMIN(3),CLHMAX(3),FACTM,DUM,FAC,HTMIN,
                          GMT(2,2),TSRF(2),FRSNWP,CIRR,CLCV(2,0:3,2),
                          CLDRAD(2,3,2),FRICEP
```

COMMON Blocks: None

SUBROUTINE CLDLYR

Argument Declarations:

```
  T      - REAL Variable (Output) - Cloud optical depth
  B      - REAL Variable (Output) - Backscattering fraction
  BU     - REAL Variable (Output) - Zenith angle dependent backscattering
             fraction
  UO     - REAL Variable (Input) - Cosine of solar zenith angle
  I      - INTEGER Variable (Input) - Atmospheric layer number
  CLA    - REAL Variable (Output) - Layer cloud fraction
  CLDP   - REAL Vector (Len = Unspecified) (Input) - Cloud cover (%)
             1 - Low etage
             2 - Middle etage
             3 - High etage
  G      - REAL Variable (Output) - Asymmetry factor
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              BETA,BETAU
      INTRINSIC         MAX
      EXTERNAL          BETA,BETAU,BRBNBD
```

Local Variable Declarations:

```
      REAL              G
```

COMMON Blocks: /CLDPAR/

SUBROUTINE CNSTNT

Argument Declarations: None

INTRINSIC and EXTERNAL Declarations:

```
CIBM  INTEGER           IBITS
CVAX  INTEGER           JIBITS
CLAH  INTEGER           JIBITS
      REAL              ADD,SUB,MUL,DIV
      DOUBLE PRECISION  DADD,DSUB,DMUL,DDIV
CUNX  REAL              FLMIN,FLMAX
CSUN  REAL              R_MIN_NORMAL,R_MAX_NORMAL
CUNX  DOUBLE PRECISION  DFLMIN,DFLMAX
CSUN  DOUBLE PRECISION  D_MIN_NORMAL,D_MAX_NORMAL
      INTRINSIC         ASIN,DBLE,REAL,INT,ABS,EXP
      INTRINSIC         IBITS
CUNX  INTRINSIC         MAX
CVAX  INTRINSIC         JIBITS
CLAH  EXTERNAL          JIBITS
CIBM  EXTERNAL          IBITS
      EXTERNAL          ADD,SUB,MUL,DIV,DADD,DSUB,DMUL,DDIV
```

Local Variable Declarations:

```
      INTEGER           I,J,K,IZ,MXR,MXD
      INTEGER*2         I2(2)
      REAL              X,Y,Z,T,ONER,ZEROR,RADIX,RADINV,A,B
      DOUBLE PRECISION  DX,DY,DZ,DT,ONED,ZEROD,DRADIX,DRADNV,DA,DB,DC,
                          DD
```

COMMON Blocks: /CONSTN/

REAL FUNCTION ADD

Argument Declarations:

```
  X       - REAL Variable - First argument
  Y       - REAL Variable - Second argument
```

REAL FUNCTION SUB

Argument Declarations:

```
  X       - REAL Variable - First argument
  Y       - REAL Variable - Second argument
```

REAL FUNCTION MUL

Argument Declarations:

```
  X       - REAL Variable - First argument
  Y       - REAL Variable - Second argument
```

REAL FUNCTION DIV

Argument Declarations:

X - REAL Variable - First argument
Y - REAL Variable - Second argument

DOUBLE PRECISION FUNCTION DADD

Argument Declarations:

DX - DOUBLE PRECISION Variable - First argument
DY - DOUBLE PRECISION Variable - Second argument

DOUBLE PRECISION FUNCTION DSUB

Argument Declarations:

DX - DOUBLE PRECISION Variable - First argument
DY - DOUBLE PRECISION Variable - Second argument

DOUBLE PRECISION FUNCTION DMUL

Argument Declarations:

DX - DOUBLE PRECISION Variable - First argument
DY - DOUBLE PRECISION Variable - Second argument

DOUBLE PRECISION FUNCTION DDIV

Argument Declarations:

DX - DOUBLE PRECISION Variable - First argument
DY - DOUBLE PRECISION Variable - Second argument

CIBM INTEGER FUNCTION IBITS

Argument Declarations:

```
I       - INTEGER Variable - Input variable
J       - INTEGER Variable - Initial position for extracting bits
K       - INTEGER Variable - Number of bits to be extracted
```

INTRINSIC and EXTERNAL Declarations:

```
CIBM  INTEGER          IBSET,IBCLR
CIBM  LOGICAL          BTEST
CIBM  INTRINSIC        IBSET,IBCLR,BTEST
```

Local Variable Declarations:

```
CIBM  INTEGER          N,NBITS
```

COMMON Blocks: None

SUBROUTINE COAT

Argument Declarations:

```
RADCOR - REAL Variable (Input) - Core radius (μm)
RADCOT - REAL Variable (Input) - Coating radius (μm)
WL     - REAL Variable (Input) - Wavelength (μm)
XNP    - COMPLEX Vector (Len = Unspecified) (Input) - Complex
           indices of refraction of core and coating
RNB    - COMPLEX Variable (Input) - Complex index of refraction of the
           medium
NSANGL - INTEGER Variable (Input) - Number of scattering angles
QABSP  - REAL Variable (Output) - Absorption coefficient (km^-1 per
           (particles cm^-3))
QSCAT  - REAL Variable (Output) - Absorption coefficient (km^-1 per
           (particles cm^-3))
GQSCAT - REAL Variable (Output) - Asymmetry coefficient times QSCAT
```

PARAMETER Declarations:

```
      INTEGER          NXMIE
      PARAMETER        (NXMIE=101)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          NCYCLE
      INTRINSIC        REAL,CMPLX,AIMAG,ABS,CONJG,INT,COS,SIN
      EXTERNAL         NCYCLE
```

Local Variable Declarations:

```
      INTEGER          N,NSTOP,N1,N2,M1,M2,M3,J,JJ,NS2
      REAL             X,Y,FN,CHIY(3),PSIY(3),P,T,DUM,TAUI,QEXT
      LOGICAL          FLAG
      COMPLEX          RFREL(2),AN(2),BN(2),REFREL,CN,C2NM1,X1,X2,Y2,
                         CONE,DNBAR,GNBAR,CRACK,BRACK,DX1(2),DX2(2),
                         DY2(2),XIY(3),CHIX2(3),CHIPX2,CHIY2(3),
                         CHIPY2,DUMC(4)
```

COMMON Blocks: /CONSTN/,/MIECOT/

REAL FUNCTION COMFNC

Argument Declarations:

```
  XN     - REAL Variable - Optical depth
  ACNP   - REAL Variable - Summing variable for Lorentz line width
  ACND   - REAL Variable - Summing variable for Doppler line width
  IV     - INTEGER Variable - Switch for Doppler/Lorentz line shape
             IV = 0 implies a Lorentz line shape
             IV = 1 implies a Doppler line shape
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SQRT,LOG,REAL,DPROD
```

Local Variable Declarations:

```
      REAL              TEST,DENC,DEND,COMC,COMD,YN
      DOUBLE PRECISION  XN2
```

COMMON Blocks: /CONSTN/

SUBROUTINE CONFIG

Argument Declarations: None

INTRINSIC and EXTERNAL Declarations:

```
CSUN  EXTERNAL          IEEE_HANDLER,ERROR_HANDLER
CIBMV EXTERNAL          ERRSET
CLAH  EXTERNAL          UNDER0
```

Local Variable Declarations:

```
CSUN  INTEGER           N
```

COMMON Blocks: None

CSUN INTEGER FUNCTION ERROR_HANDLER

Argument Declarations:

```
  SIG    - INTEGER Variable -
  CODE   - INTEGER Variable - Error code index
  CNTEXT - INTEGER Vector (Len = Unspecified) -
```

Local Variable Declarations:

```
CSUN  CHARACTER*14      LABEL
```

COMMON Blocks: None

SUBROUTINE COUPLE

Argument Declarations:

```
  V      - REAL Variable (Input) - Wavenumber (cm-1)
  DV     - REAL Variable (Input) - Wavenumber increment (cm-1)
  ISCENE - INTEGER Array (Dim = MAXLAT x Unspecified) (Input) - Background
           scene index
  NMOLEC - INTEGER Variable (Input) - Number of molecules
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input) - Switch for
           model atmospheres
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,NAZMAX,NASMAX,ISMX,NBAND,NZSMAX,NMATL,
                         MAXLAT,MAXLON,NGMAX,NVSMAX,MOLMAX
      PARAMETER        (MLMAX=140, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8, NBAND=16)
      PARAMETER        (NMATL=28)
      PARAMETER        (MAXLAT=3, MAXLON=1)
      PARAMETER        (NGMAX=15, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      INTRINSIC        MAX,SIN,ABS,MIN
      EXTERNAL         XTERP,BCKGND,PROFAC,INICPL,BKGDBD
```

Local Variable Declarations:

```
      INTEGER          I,L,K,M,LTER,KEY,KEYP,LP,MLP,ITER,NPTS,LTOP,
                         MTOP,LERR,KK,LL,ITRP0,ISPACE,KX,LX,NBCK(2,2)
      REAL             EMISS,HP0(2),HPX(MLMAX,NBAND),HMX(MLMAX,NBAND),
                         EMBCK,EMSPAC,REFBCK,WL,DUM1,DUM2,HSOLAR,CC,
                         HLUNAR,PROJL(6),RADRF,HPOLD(0:MLMAX+1),FAC,
                         HMOLD(0:MLMAX+1),ERR,ERRP,ERRM,REF0,PROJS(6),
                         BCKFAC(MAXLAT,MAXLON),BCKSUM(6,NMATL),HSKY0,
                         PRJS1(6),HLNR0,PRJL1(6),TAU1,PS90,PL90,PB90,
                         AZO90,AZS90,AZL90,HSCAT0,HSLR0,DUM,SHDWS,
                         SHDWL
      CHARACTER*7      HTYPE(2)

COMMON Blocks:         /BACKGD/,/CONSTN/,/HEADER/,/INITAL/,/LYRSTO/,
                         /MSPARM/,/PATH4/
```

REAL FUNCTION CSPHFN

Argument Declarations:

```
  ASYM   - REAL Variable - Asymmetry factor
  THETA  - REAL Variable - Scattering angle (deg)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        COS,INT,REAL,MAX,MIN,SQRT
```

Local Variable Declarations:

```
      INTEGER          I,IG,IGP
      REAL             G,GCS(-200:200),FAC,G2,CST

COMMON Blocks:         /CONSTN/
```

REAL FUNCTION DBANDS

Argument Declarations:

```
  XMLBDA - REAL Variable - Ecliptic longitude (deg)
  BETA   - REAL Variable - Ecliptic latitude (deg)
  LABSUN - REAL Variable -
  V      - REAL Variable - Wavenumber (cm-1)
  DV     - REAL Variable - Wavenumber increment (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              ZLAT,SOLAR,PLANCK
      INTRINSIC         REAL,ABS,MIN
      EXTERNAL          PLANCK,SOLAR,ZLAT,ZOD2BD
```

Local Variable Declarations:

```
      INTEGER           I,IREC,IRECP
      REAL              FAC,REC,AU,DUM,SRC,RSOL,RSUN,SCAT,THERM
```

COMMON Blocks: /ZODBND/

SUBROUTINE DBINIT

Argument Declarations: None

PARAMETER Declarations:

```
      INTEGER           MOLMAX,MLIDMX
      PARAMETER         (MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INT,INDEX,LEN,ABS
      EXTERNAL          DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           I,N,IOS,NVRMXP,IXM,ISWUFT
CIBM  INTEGER           LRECL,IERR
      REAL              DUMMY
      CHARACTER*120     NFILE
```

COMMON Blocks: /CONSTN/,/DEVCNM/,/DEVICE/,/MOLECP/

REAL FUNCTION DDIF

Argument Declarations:

```
  U2      - REAL Variable - Upward flux, layer 2
  U3      - REAL Variable - Upward flux, layer 3
  D1      - REAL Variable - Downward flux, layer 1
  D2      - REAL Variable - Downward flux, layer 2
  D3      - REAL Variable - Downward flux, layer 3
  R1S     - REAL Variable - Directional reflection coefficient, layer 1
  R2      - REAL Variable - Diffuse reflection coefficient, layer 2
  R2S     - REAL Variable - Directional reflection coefficient, layer 2
  T2      - REAL Variable - Transmission, layer 2
  T3      - REAL Variable - Transmission, layer 3
  G       - REAL Variable - Composite R and T from FUNCTION GAM
```

Local Variable Declarations:

```
      REAL              T,R,RR
```

COMMON Blocks: None

SUBROUTINE DEFALT

Argument Declarations:

```
  ISWINP - INTEGER Vector (Len = Unspecified) (Input) - Input switches
  IFLTR  - INTEGER Variable (Output) - Filter index
  ISHINE - INTEGER Variable (Output) - Earth/skyshine index
  NXTRA  - INTEGER Variable (Output) - Number of extra altitudes
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,NANTMX,MLMAX,
                          MAXLAT,MAXLON,ISMX,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NANTMX=25, NVSMAX=20)
      PARAMETER         (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS,AINT,SIGN,MOD,MAX
      EXTERNAL          EXOATM,GBLBCK,DEVCBD
```

Local Variable Declarations:

```
      INTEGER           I,ISCENE,IXOTMP,KK,LL
      REAL              TMIDN,TNOON,TSURF,FRSNW,FRWTR,CLDCVP(0:3)
```

COMMON Blocks: /ANTECD/,/DEVICE/,/HEADER/,/USERDF/

SUBROUTINE DEFBCK

Argument Declarations:

```
  NSRCE  - INTEGER Variable (Input) - Position index for source
  THETA  - REAL Variable (Input) - Source-background earth-center angle (deg)
  JBKGD  - INTEGER Variable (Input) - Background index
  IGEOM  - INTEGER Variable (Input) - Geometry number
  FRSNW  - REAL Vector (Len = Unspecified) - Percentage snow at end of
             line-of-sight (%)
  FRICE  - REAL Vector (Len = Unspecified) - Percentage ice at end of
             line-of-sight (%)
  FRWTR  - REAL Vector (Len = Unspecified) - Percentage water at end of
             line-of-sight (%)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,NAZMAX,NASMAX,NGMAX,NZSMAX,NVSMAX,
                          MAXLAT,MAXLON,ISMX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          BCKCHK,INDXBK,SPTRIG,SETBCK
```

Local Variable Declarations:

```
      INTEGER           I,MM,NLOCAT
      REAL              XLATP,XLONP,TAIRP,CLDCVP(0:3),TDUM,TMIDN,TNOON,
                          AZP,SOLAZP,FRSNWP,FRICEP,FRWTRP
```

COMMON Blocks: /HEADER/,/PATH5A/,/PATH5C/

SUBROUTINE DEMSXX

Argument Declarations:

```
  IGRND  - INTEGER Variable (Input) - Material index
  V      - REAL Variable (Input) - Wavenumber (cm-1)
  DV     - REAL Variable (Input) - Wavenumber increment (cm-1)
  TEMP   - REAL Vector (Len = 0:Unspecificed) (Input) - Temperature of each
           layer in material (K)
  EMV    - REAL Variable (Output) - Emissivity for vertical polarization
  EMH    - REAL Variable (Output) - Emissivity for horizontal polarization
  ANGLE  - REAL Variable (Input) - Elevation angle (deg)
  DH     - REAL Variable (Input) - Standard deviation of the distribution of
           heights (m)
  IRGH   - INTEGER Variable (Input) - Roughness type
```

PARAMETER Declarations:

```
      INTEGER          NLMAX
      PARAMETER        (NLMAX=10)
```

INTRINSIC and EXTERNAL Declarations:

```
      COMPLEX          EMTREF,SEAWTR,INDEXW,INDEXI
      INTRINSIC        CMPLX,AIMAG,MAX,DBLE,DPROD,EXP,REAL,ABS,SQRT,
     +                   SIN
      EXTERNAL         DIREMS,EMTREF,INDEXI,INDEXW,SEAWTR,SOIL,EMISBD
```

Local Variable Declarations:

```
      INTEGER          NLAYER,ITYPE,NINCL,IGRD
      REAL             WL,DELS
      COMPLEX          DSOIL,AIR,WATER,ICE,INEF(0:NLMAX),INDX(2)
```

COMMON Blocks: /CDRYDS/,/WETNES/

REAL FUNCTION DENAIR

Argument Declarations:

```
  P      - REAL Variable - Pressure (mb)
  T      - REAL Variable - Temperature (K)
  CMOL   - REAL Vector (Len = Unspecified) - Molecular concentrations (ppm)
```

PARAMETER Declarations:

```
      INTEGER          MLIDMX
      PARAMETER        (MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             VIRIAL
      EXTERNAL         VIRIAL,MOLPBD
```

Local Variable Declarations:

```
      INTEGER          K
      REAL             RSTAR,P0,XMAIR,V2,V3
```

COMMON Blocks: /MOLDAT/

REAL FUNCTION DENWTR

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

PARAMETER Declarations:

```
      INTEGER           NPTS
      PARAMETER         (NPTS=56)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           ITRP0
      REAL              T(NPTS),DEN(NPTS)
      REAL              TC
```

COMMON Blocks: None

REAL FUNCTION DEPOL

Argument Declarations:

WL - REAL Variable - Wavelength (μm)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      REAL              WLD(36),DPL(36)
```

COMMON Blocks: None

DOUBLE PRECISION FUNCTION DERF

Argument Declarations:

DX - DOUBLE PRECISION Variable - Argument of error function

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX,MIN,EXP,ABS
```

Local Variable Declarations:

```
      DOUBLE PRECISION A(5),T,P,DUM
```

COMMON Blocks: None

SUBROUTINE DESAER

Argument Declarations:

WSPD - REAL Variable (Input) - Wind speed at 10 m altitude (m/sec)
VIS - REAL Variable (Output) - Meteorological range (km)
DESEXT - REAL Vector (Len = Unspecified) (Output) - Extinction coefficient (km^{-1})
DESABS - REAL Vector (Len = Unspecified) (Output) - Absorption coefficient (km^{-1})
ASYMD - REAL Vector (Len = Unspecified) (Output) - Asymmetry factor

PARAMETER Declarations:

```
      INTEGER          NWLAER
      PARAMETER        (NWLAER=47)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        INT,MIN
      EXTERNAL         DSRTBD
```

Local Variable Declarations:

```
      INTEGER          I,NWSPD
      REAL             EXT55,RAYSCT,WIND(4),FAC,DWND
```

COMMON Blocks: /CONSTN/,/DESDAT/

SUBROUTINE DFLT2

Argument Declarations:

```
  ITYPE  - INTEGER Variable (Input) - Latitude index
  ISEASN - INTEGER Variable (Input/Output) - Season index
  IAERO1 - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Boundary layer aerosol index
  IAERO2 - INTEGER Variable (Input/Output) - Stratospheric aerosol index
  IHAZE  - INTEGER Variable (Input/Output) - Haze profile index
  IUPPER - INTEGER Variable (Input/Output) - Upper haze profile index
  ISMX   - INTEGER Variable (Input) - Maximum DIMENSION of MC
  MP     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Pressure profile index
  MT     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Temperature profile index
  MC     - INTEGER Array (Dim = ISMX x MAXLAT x Unspecified)
             (Input/Output) - Molecular concentration profile index
  MA     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Model atmosphere index
  VIS    - REAL Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Sea-level visible range (km)
  RE     - DOUBLE PRECISION Variable (Output) - Earth radius (km)
  MONTH  - INTEGER Variable (Input) - Month of the year (Jan =1 ,...)
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLONG  - REAL Variable (Input) - Longitude (deg)
  LATSTR - REAL Vector (Len = Unspecified) (Output) - Latitude of the
             model atmosphere.
  LONSTR - REAL Vector (Len = Unspecified) (Output) - Longitude of the
             model atmosphere.
  NLAT   - INTEGER Variable (Output) - Number of latitudes
  NLON   - INTEGER Variable (Output) - Number of longitudes
  IBKGD  - INTEGER Variable (Input) - Background index
  HBCK   - REAL Variable (Input) - Terrain altitude (km)
```

PARAMETER Declarations:

```
      INTEGER           NL,MAXLAT,MAXLON
      PARAMETER         (NL=50, MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           MDLATM,IDAERO
      INTRINSIC         ABS,SQRT,COS,SIN,MIN,DBLE,INT
      EXTERNAL          ATMSBD,MDLATM,IDAERO
```

Local Variable Declarations:

```
      INTEGER           K,KK,LL,ITYPE0,JTYPE
```

COMMON Blocks: /ATMDAT/,/CONSTN/

SUBROUTINE DFLT8

Argument Declarations:

```
  V1      - REAL Vector (Len = Unspecified) (Input/Output) - Initial
              wavenumber (cm-1 or micron)
  V2      - REAL Vector (Len = Unspecified) (Input/Output) - Final
              wavenumber (cm-1 or micron)
  DVI     - REAL Vector (Len = Unspecified) (Input/Output) - Calculation
              width (cm-1)
  IDV     - INTEGER Vector (Len = Unspecified) (Input) - Wavenumber/
              Wavelength index
                IDV = 1 implies wavenumber (cm-1)
                IDV = 2 implies wavelength (micron)
  DWL     - REAL Vector (Len = Unspecified) (Output) - Calculation
              width (micron)
  NV      - INTEGER Variable (Output) - Number of wavenumber sets of values
  NVMAX   - INTEGER Variable (Input) - Maximum number of wavenumber sets of
              values
  ISPCAL - INTEGER Variable (Output) - Spectral calculation index
              ISPCAL = 1 implies 2 cm-1 band parameters
              ISPCAL = 3 implies line-by-line millimeter wave parameters
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX,MLIDMX
      PARAMETER         (MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              DVINCR
      CHARACTER*2       UPCASE
      INTRINSIC         MAX,MIN,ABS,AINT
      EXTERNAL          DVINCR,RDLINE,GETVEC,UPCASE,DEVCBD
```

Local Variable Declarations:

```
      INTEGER           I,L,N1,N2,N3
      REAL              VR(2),VI,VF,VX,DVX
      CHARACTER*255     VARIAB,VARS1,VARS2,VARS3
```

COMMON Blocks: /CONSTN/,/DEVICE/,/MOLECP/

COMPLEX FUNCTION DIREFL

Argument Declarations:

```
  DOTPR  - REAL Variable - Dot product of incident vector to surface normal
  DIELEC - COMPLEX Variable - Permittivity (dielectric constant and
             conductivity) of surface
  XMU    - COMPLEX Variable - Permeability of surface
  IPOLAR - INTEGER Variable - Polarization index
             IPOLAR = 1 implies polarization parallel to surface
             IPOLAR = 2 implies polarization normal to surface
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         CMPLX,SQRT
```

Local Variable Declarations:

```
      COMPLEX           EP,CCST
```

COMMON Blocks: None

SUBROUTINE DISEND

Argument Declarations:

```
  IFDIS  - INTEGER Variable (Input) - File number for DIS file
```

PARAMETER Declarations:

```
      INTEGER           NVSMAX,NGMAX
      PARAMETER         (NVSMAX=20, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           NHDR(2),NVAR(NGMAX),IV,IVSET,IVS,IG,NVSET,
     +                    NVS(NVSMAX),IH,IOS,ICHK,IHDR(6000),
     +                    NGEOM,IGEOM
      REAL              HDR(7500),VAR(10000)
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE

      EQUIVALENCE       (NGEOM,IHDR(1)),(NVSET,IHDR(2)),
     +                    (NVS(1),IHDR(3))
```

SUBROUTINE DISPRN

Argument Declarations:

```
  IFDIS  - INTEGER Variable (Input) - File number for DIS file
  IGEOM  - INTEGER Variable (Input) - Number of geometry
  NAZ    - INTEGER Vector (Len = Unspecified) (Input) - Number of
           observer azimuths
  NASPCT - INTEGER Vector (Len = Unspecified) (Input) - Number of
           earth/skyshine elevation angles
  NAZSH  - INTEGER Variable (Input) - Number of earth/skyshine
           azimuth angles
```

PARAMETER Declarations:

```
      INTEGER          NGMAX,NAZMAX,NASMAX,NZSMAX,NMATL,MAXLAT,
     +                   MAXLON,MLMAX
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (NMATL=28)
      PARAMETER        (MAXLAT=3, MAXLON=1)
      PARAMETER        (MLMAX=100)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      EXTERNAL         IOERR
```

Local Variable Declarations:

```
      INTEGER          L,M,MM,IOS
```

COMMON Blocks: /BCKDAT/,/INTSTO/

REAL FUNCTION DNDR

Argument Declarations:

```
  RADN   - REAL Vector (Len = Unspecified) - Midpoints of the radii
           intervals (microns)
  IMATRL - INTEGER Variable - Particle material index
  TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             GAMMLN
      INTRINSIC        REAL,EXP,LOG,SQRT,MAX,MIN,INT,AINT,ABS,DBLE
      EXTERNAL         GAMMLN
```

Local Variable Declarations:

```
      INTEGER          I,IP
      REAL             TSSQ,SUM,CON,DR,XI,FAC,RATE,GAM,D0,DP,R0P,
                         DIAM(5),DL(5),SIZEN
      DOUBLE PRECISION FN100,FN1000,B1,B2
```

COMMON Blocks: /CONSTN/,/MATERL/

REAL FUNCTION DPLDT

Argument Declarations:

```
  TEMP    - REAL Variable - Temperature (K)
  V       - REAL Variable - Wavenumber (cm-1)
  DV      - REAL Variable - Wavenumber increment (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DBLE,EXP,DPROD,LOG
```

Local Variable Declarations:

```
      INTEGER           I
      REAL              VP
      DOUBLE PRECISION X,Y,C1,C2,XMU(3),WT(3),DPL
```

COMMON Blocks: /CONSTN/

SUBROUTINE DRTLAY

Argument Declarations:

```
  R       - REAL Variable (Output) - Reflection coefficient
  T       - REAL Variable (Output) - Transmission coefficient
  BU      - REAL Variable (Input) - Backscatter coefficient
  PHI     - REAL Variable (Input) - Elevation angle (deg)
  W       - REAL Variable (Input) - Scattering albedo
  TAU     - REAL Variable (Input) - Layer optical depth
  RE      - DOUBLE PRECISION Variable (Input) - Radius of the earth (km)
  ZM      - REAL Variable (Input) - Prior altitude (km)
  Z       - REAL Variable (Input) - Altitude of interest (km)
  ZP      - REAL Variable (Input) - Next altitude (km)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SQRT,EXP,ABS,DBLE,REAL,SIN
```

Local Variable Declarations:

```
      REAL              U,EM,G
```

COMMON Blocks: /CONSTN/

REAL FUNCTION DVINCR

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  DVI    - REAL Variable - Initial wavenumber increment (cm-1)
  IDV    - INTEGER Variable - Wavenumber/wavelength index
             IDV = 1 implies wavenumber (cm-1)
             IDV = 2 implies wavelength (micron)
             IDV = 3 implies frequency (GHz)
  DWL    - REAL Variable - Wavelength increment (micron)
```

PARAMETER Declarations:

```
      INTEGER          MOLMAX,MLIDMX
      PARAMETER        (MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        AINT,MAX
```

COMMON Blocks: /MOLECP/

SUBROUTINE ECLGAL

Argument Declarations:

```
  ALPHA  - REAL Variable (Input) - Ecliptic azimuth (deg)
  DELTA  - REAL Variable (Input) - Ecliptic elevation (deg)
  XL     - REAL Variable (Output) - Galactic azimuth (deg)
  XB     - REAL Variable (Output) - Galactic elevation (deg)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        SIN,COS,ATAN2,ABS
```

Local Variable Declarations:

```
      REAL             CSA,SNA,CSD,SND,CS0,SN0,DUM1,DUM2,DUM3,XLP,XBP,
                         CSL,SNL
```

COMMON Blocks: /CONSTN/

REAL FUNCTION EHBSL0

Argument Declarations:

X - REAL Variable - Argument

INTRINSIC and EXTERNAL Declarations:

```
      DOUBLE PRECISION POLY
      INTRINSIC        DBLE,ABS,EXP,SQRT,REAL
      EXTERNAL         POLY
```

Local Variable Declarations:

```
      DOUBLE PRECISION C1(7),C2(9),T,T1,T2
```

COMMON Blocks: None

REAL FUNCTION EMISSV

Argument Declarations:

R - REAL Variable - Distance from sun
V - REAL Variable - Wavenumber (cm^{-1})

PARAMETER Declarations:

```
      INTEGER          MOLMAX,MLIDMX
      PARAMETER        (MOLMAX=26, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             SOLAR,PLANCK
      INTRINSIC        MAX,MIN,INT,LOG10,REAL
      EXTERNAL         ZOD1BD,SOLAR,PLANCK
```

Local Variable Declarations:

```
      INTEGER          IW,IWP,ICEN,ICENP
      REAL             DMIN,DMAX,DSLOPE,ALINE,FACW,FACD,C,AWL,
                         SOLDIS,V1,V2,TEMP
```

COMMON Blocks: /MOLECP/,/SILEMS/

COMPLEX FUNCTION EMTREF

Argument Declarations:

```
  INDEXM - COMPLEX Variable - Index of refraction of matrix
  INDEXI - COMPLEX Vector (Len = Unspecified) - Index of refraction of
             inclusions
  F      - REAL Vector (Len = Unspecified) - Volume fraction of inclusions
  NINCL  - INTEGER Variable - Number of inclusion types
  ITYPE  - INTEGER Variable - Type of mixture
             ITYPE = 0 implies the Bruggeman effective medium theory which
                       applies to a two-component mixture in which there
                       are no distinguishable inclusions embedded in a
                       definite matrix
             ITYPE = 1 implies Maxwell-Garnett theory for spherical
                       inclusions in a matrix
             ITYPE = 2 implies the Lorentz-Lorens form of the Clausius-
                       Mosotti equation for a mixture; this equation holds
                       for gases, but is only an approximation for liquids
                       (i.e., it fails near strong absorption bands)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        SQRT,CMPLX
```

Local Variable Declarations:

```
      INTEGER          I
      COMPLEX          E,EM,VF,BETA,EAV,C1,C2,DUM
```

COMMON Blocks: None

SUBROUTINE ENDPT

Argument Declarations:

```
R      - REAL Vector (Len = Unspecified) (Input/Output) - Slant range (km)
THETA  - REAL Vector (Len = Unspecified) (Input/Output) - Earth center
           angle (rad)
PHI    - REAL Vector (Len = Unspecified) (Input/Output) - Elevation angle
           (rad)
IZ     - INTEGER Vector (Len = Unspecified) (Input/Output) - Altitude index
LLST   - INTEGER Variable (Input) - Location of last valid point on ray
SLRNG  - REAL Variable (Input) - Total slant range (km)
BETA   - REAL Variable (Input) - Total earth center angle (deg)
JTPGM  - INTEGER Variable (Input) - Type of calculation
           JTPGM = 5 implies slant range is specified
           JTPGM = 6 implies earth center angle is specified
           JTPGM = 9 implies earth center angle is specified
HSEND  - REAL Variable (Output) - End point altitude (km)
IERR   - INTEGER Variable (Output) - Error index
           IERR = 0 implies no error encountered
           IERR = -1 implies initial value exceeds specified value or final
                     value does not exceeds specified value
```

PARAMETER Declarations:

```
      INTEGER            MLMAX,ISMX,NNNMAX,NAZMAX,NASMAX,NGAS,NGMAX,
                           NZSMAX,MAXLAT,MAXLON,NPTS,NVSMAX,NVSA,MOLMAX,
                           MLIDMX
      PARAMETER          (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER          (MLMAX=140, NNNMAX=5, NGAS=6)
      PARAMETER          (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER          (MAXLAT=3, MAXLON=1, NVSMAX=20, NVSA=9)
      PARAMETER          (NPTS=2000)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER            ISTAER
      REAL               STRCN2,XTERP,HAZE
      INTRINSIC          REAL,DBLE,MAX,MIN,COS,ACOS,SIN,SQRT,SIGN,INT,
                           ABS
      EXTERNAL           STRCN2,XTERP,EQABS,ISTAER,MOLPBD,AERSOL,HYDROM,
                           HAZE,CLDRBD
```

Local Variable Declarations:

```
      INTEGER            I,J,K,L,MLP,KK,LL,IDRCT,JM,MLX,KL,JDRCT,KPHI,
                           IZI(NPTS),ITRPAU(MAXLAT,MAXLON),ITRP0,
                           ISTPAU(MAXLAT,MAXLON),JMM,JP,KLAT,KLON,
                           IPRINT
      REAL               WL,DTDPJ(NPTS),XMHI(NPTS),XDRCT,VISX,VI,VF,
                           DZL,PLI,TLI,RHLI,WI(ISMX),PRTNFI(ISMX),
                           CMOLI(ISMX),PLUMIF(NNNMAX,NGAS),
                           PLUMIG(NGAS),FAC,TAV,FACICE,FACSNW,DUM,ZLP
      DOUBLE PRECISION   MH,MHM,SNELL,TD,RD,PX(NPTS),DMDH,DXMH1,DXMH2,
                           DPHI1,DPHI2,RX,PX0,DFAC,DRD,DTD,XMH0
      LOGICAL            DUPLIC

COMMON Blocks:           /CLDRN/ ,/CONSTN/,/HEADER/,/INITAL/,/MOLCON/,
                           /MOLECP/,/PLMDAT/,/VSADTA/
```

SUBROUTINE EPHEML

Argument Declarations:

```
  LATIT  - REAL Variable (Input) - Geographical Latitude of observer (deg)
             (+ implies North)
  LONG   - REAL Variable (Input) - Geographical Longitude of observer (deg)
             (+ implies East)
  LONSUN - DOUBLE PRECISION Variable (Input) - Longitude of the sun (deg)
  LABSUN - DOUBLE PRECISION Variable (Input) - Mean ecliptic longitude of the
             sun (deg)
  PERSUN - DOUBLE PRECISION Variable (Input) - Mean perigee of the sun (deg)
  OBLIQ  - DOUBLE PRECISION Variable (Input) - Obliquity of the ecliptic (deg)
  SOLEV  - REAL Variable (Input) - Elevation of sun (deg)
  SOLAZ  - REAL Variable (Input) - Azimuth of sun (deg)
               0.0 implies North (or undefined)
              90.0 implies East
             180.0 implies South
             270.0 implies West
  SOLDIS - REAL Variable (Input) - Earth-sun distance normalized by mean
             distance
  XLUNEV - REAL Variable (Output) - Elevation of moon (deg)
  XLUNAZ - REAL Variable (Output) - Azimuth of moon (deg)
               0.0 implies North (or undefined)
              90.0 implies East
             180.0 implies South
             270.0 implies West
  PHLUNR - REAL Variable (Output) - Lunar phase (deg)
               0.0 implies new moon
              90.0 implies first quarter
             180.0 implies full moon
             270.0 implies last quarter
             360.0 implies new moon
  XLNDIS - REAL Variable (Output) - Earth-moon distance normalized
             by the mean distance
  IECL   - INTEGER Variable (Output) - Lunar eclipse index
             IECL = 0 implies no lunar eclipse
             IECL = 1 implies that a lunar eclipse is likely to affect the
                        calculations.  Consult an almanac.  If there is no
                        eclipse, the output will be reliable.
  IECS   - INTEGER Variable (Output) - Solar eclipse index
             IECS = 0 implies no solar eclipse
             IECS = 1 implies that a solar eclipse is likely to affect the
                        calculations.  Consult an almanac.  If there is no
                        eclipse, the output will be reliable.
  ETIME  - DOUBLE PRECISION Variable (Input) - Ephemeris time since
             Jan 1 1900, 12:00 Noon, GMT (days)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          REAL,MAX,MIN,SIN,COS,ASIN,ACOS,ATAN2,SIGN,
                           ABS,DBLE,ATAN,MOD
      EXTERNAL           LUNPBD
```

Local Variable Declarations:

```
      INTEGER            I
      REAL               LHSUN,LHMOON,LOCEL,MOORAD,ARGUM,TINMOO,PARMEA,SUNRAD,
                           ERMAX,GHSUN,GHMOON,DECMOO,PARLOC,DIFLON,TEMP16,
                           TEMP17,DUMM,PARLAX,AZIMOO,DECSUN,XS,YS,ZS,XM,YM,ZM,
                           GELONG,SUNMOO,CRITEL,THETA
      DOUBLE PRECISION   GHARI,LONMOO,LATMOO,LABMOO,PERMOO,NODMOO,
                           CENT,DUM,BLM,BLS,BRF,BRD,RATE,DAYPYR
```

COMMON Blocks: /CONSTN/,/PERLUN/

SUBROUTINE EPHEMS

Argument Declarations:

```
  LAT    - REAL Variable (Input) - Latitude (in degrees and fractions of
             degrees,   is north)
  LONG   - REAL Variable (Input) - Longitude (in degrees and fractions of
             degrees,   is east)
  DAY    - INTEGER Variable (Input) - Day of the month
  MONTH  - INTEGER Variable (Input) - Month of the year
  YEAR   - INTEGER Variable (Input) - Year
  TIME   - REAL Variable (Input) - Time (decimal) local standard (LST) or
             Greenwich mean (GMT)
  ITIME  - INTEGER Variable (Input) - Time index
             ITIME = 0 implies local standard time
             ITIME = 1 implies Greenwich mean time
             ITIME = 2 implies local daylight savings time
  SOLAZ  - REAL Variable (Output) - Azimuth angle (in degrees and fractions of
             a degree)
               0.0 implies north (or undefined)
              90.0 implies east
             180.0 implies south
             270.0 implies west
  SOLEV  - REAL Variable (Output) - Elevation angle (in degrees and fractions of
             a degree)
  SOLDIS - REAL Variable (Output) - Normalized solar-earth distance
             SOLDIS = 1.0 implies the mean distance
  XLUNEV - REAL Variable (Output) - Lunar elevation (deg)
  XLUNAZ - REAL Variable (Output) - Lunar azimuth (deg)
               0.0 implies north (or undefined)
              90.0 implies east
             180.0 implies south
             270.0 implies west
  XLUNDS - REAL Variable (Output) - Normalized lunar distance
  PHLUNR - REAL Variable (Output) - Lunar phase (deg)
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,MOLMAX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SLPOS
      DOUBLE PRECISION  EPHTIM
      INTRINSIC         ABS,SIN,COS,MOD,AINT,INT,SIGN,ASIN,ACOS,TAN,
                          REAL,ATAN,DBLE,SQRT,MAX,MIN
      EXTERNAL          PLANET,EPHEML,SPTRIG,SLPOS,EPHTIM
```

Local Variable Declarations:

```
      INTEGER           I,J,IECL,IECS
      REAL              LHA,DCIR,ZNLONG,GMTDEG,ERR,APPLON,RASC,DUMX,
                          PSAZ,ECCEN,TRANOM,ABERR,OBLQMN,ECANOM,DAYCNT,
                          ASCMN,SOLAT,APRASC,EQTIME,HRANG,DECLIN,DECL,
                          BETAS,BETAL,DUMMY,TANOM,TEMP
      DOUBLE PRECISION  LONSUN,LABSUN,PERSUN,OBLIQ,CENT,DPHI,A,XMNLAT,
                          DDCIR,ANOMN,PERTUB,PERVEN,PERJUP,OBLNUT,ETIME
```

COMMON Blocks: /CONSTN/,/FLAGS/,/INITAL/

```
                    DOUBLE PRECISION FUNCTION EPHTIM

Argument Declarations:

  DAY    - INTEGER Variable (Input) - Day of the month
  MONTH  - INTEGER Variable (Input) - Month of the year
  YEAR   - INTEGER Variable (Input) - Year
  TIME   - REAL Variable (Input) - Time (decimal) local standard (LST)
             or Greenwich mean (GMT)
  ITIME  - INTEGER Variable (Input) - Time index
             ITIME = 0 implies local standard time
             ITIME = 1 implies Greenwich mean time
             ITIME = 2 implies local daylight savings time

PARAMETER Declarations:

      INTEGER           NYRMAX
      PARAMETER         (NYRMAX=175)

INTRINSIC and EXTERNAL Declarations:

      INTRINSIC       ABS,AINT,INT,SIGN,REAL,DBLE,MAX,MIN

Local Variable Declarations:

      INTEGER           I,J,IYR
      REAL              DT(NYRMAX),DYR,FAC,YR1,YR2,TEMP,DAYCNT,ZNLONG,
                          GMTDEG,DCIR
      DOUBLE PRECISION UTIME,CENT,DDCIR

COMMON Blocks:  None
```

SUBROUTINE EQABS

Argument Declarations:

```
ZL      - REAL Variable (Input) - Altitude (km)
PL      - REAL Variable (Output) - Pressure (mb)
TL      - REAL Variable (Output) - Temperature (K)
RHL     - REAL Variable (Output) - Relative humidity
XMH     - REAL Variable (Output) - Refractive bending constant
W       - REAL Vector (Len = Unspecified) (Output) - Equivalent absorber
            amounts (km^-1)
PRTNFN  - REAL Vector (Len = Unspecified) (Output) - Partition function for
            each molecule
RE      - DOUBLE PRECISION Variable (Input) - Radius of the earth (km)
WL      - REAL Variable (Input) - Wavelength (μm)
CMOLL   - REAL Vector (Len = Unspecified) (Output) - Molecular concentrations
            (ppm)
PLUMEF  - REAL Array (Dim = NNNMAX X Unspecified) (Output) - Line strength
            partition function
PLUMEG  - REAL Vector (Len = Unspecified) (Output) - Fine structure partition
            function
NNNMAX  - INTEGER Variable (Input) - Maximum number of partitions
IPRINT  - INTEGER Variable (Input) - Print index
KK      - INTEGER Variable (Input) - Latitude index
LL      - INTEGER Variable (Input) - Longitude index
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NGAS,NASMAX,NL,MAXLATlMAXLON,NGMAX,NLUPR,
                          NTEXO,NVSA,ISMX,MOLMAX,MLIDMX,NVSMAX,NAZMAX,
                          NZSMAX
      PARAMETER         (MLMAX=140, NGAS=6, NASMAX=15, NAZMAX=30)
      PARAMETER         (NL=50, NLUPR=8, NTEXO=11, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15, NVSA=9)
      PARAMETER         (MLIDMX=45, NZSMAX=4)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           MDLATM
      REAL              XTERP,PARTIT,SATUR,RELHUM
      DOUBLE PRECISION  REFRAC
      INTRINSIC         MAX,REAL,MIN,ABS,INT
      EXTERNAL          XTERP,REFRAC,ATMSBD,UPPRBD,PARTIT,BNDMLG,
                          MOLPBD,SATUR,RELHUM,STMLBD,EXMLBD,MDLATM
```

Local Variable Declarations:

```
      INTEGER           ITRP1,ITRP2,MLC,I,K,IWATER,MPX,MTX,MCX,IT,M1,
                          M2,MK
      REAL              P0,T0,PS,TS,SATURL,FAC,ZLBL,RHDUM,ABSLAT,
                          FACLAT,P1,P2,T1,T2,C1,C2
```

```
COMMON Blocks:          /ATMDAT/,/CONSTN/,/EXTMOL/,/FLAGS/,/HEADER/,
                          /MOLCON/,/MOLDAT/,/MOLECP/,/STDMOL/,/UPRATM/,
                          /USERDF/,/VSADTA/
```

SUBROUTINE EQUABS

Argument Declarations:

```
  HXTRA  - REAL Vector (Len = Unspecified) (Input) - Extra altitudes in
             altitude grid
  NXTRA  - INTEGER Variable (Input) - Dimension of HXTRA
  TITLE  - CHARACTER*(*) Variable (Input) - Title in printout
  HEADNG - CHARACTER*(*) Variable (Input) - Heading in printout
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,NNNMAX,NAZMAX,NASMAX,NGAS,MAXLAT,
                          MAXLON,NGMAX,NZSMAX,NL,NVSMAX,NVSA,MOLMAX,
                          MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NNNMAX=5, NGAS=6)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20, NVSA=9, NL=50)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           ISTAER
      REAL              STRCN2,XTERP,HAZE,HEYMS,HLOWT,VISRH
      CHARACTER*72      IOERR
      INTRINSIC         REAL,MAX,MIN,SQRT,MOD,DBLE
      EXTERNAL          AERSOL,EQABS,ISTAER,STRCN2,NXXPAU,CLDRBD,HLOWT,
                          CHRCBD,DEVCBD,HAZE,MOLPBD,XTERP,HEYMS,IOERR,
                          HYDROM,SETALT,SKYNOI,CLDALT,ATMSBD,CHANGE,
                          VISRH
```

Local Variable Declarations:

```
      INTEGER           I,L,M,LM,LP,NLP,ITRPAU(MAXLAT,MAXLON),
                          ISTPAU(MAXLAT,MAXLON),NMSPAU(MAXLAT,MAXLON),
                          IBNLYR,IOS,KK,LL,NLINES,ITRP0,IPRINT,K,JCLD
      REAL              ZP(MLMAX),FACSNW,FACICE,WL,XL0(MAXLAT,MAXLON),
                          DMDH,VISX,DUM,CIRICL(MAXLAT,MAXLON),TAV,
                          HBLYR,SUMC,VI,VF,ZLP
CCM3  REAL                XLOSCH
      CHARACTER*8       CLABRV,MOLSYM(MLIDMX)
```

```
COMMON Blocks:          /ATMDAT/,/BCKDAT/,/CHRCNM/,/CLDRN/ ,/CONSTN/,
                          /DEVICE/,/HEADER/,/INITAL/,/MOLCON/,/MOLECP/,
                          /OUTPUT/,/PLMDAT/,/VSADTA/
```

SUBROUTINE EQUECL

Argument Declarations:

```
ALPHA  - REAL Variable (Input) - Equatorial azimuth (deg)
DELTA  - REAL Variable (Input) - Equatorial elevation (deg)
YEAR   - REAL Variable (Input) - Julian date (year)
XLMBDA - REAL Variable (Output) - Ecliptic azimuth (deg)
BETA   - REAL Variable (Output) - Ecliptic elevation (deg)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SIN,COS,ATAN2,ABS
```

Local Variable Declarations:

```
      REAL              T,EA,CSA,SNA,CSD,SND,CSE,SNE,DUM1,DUM2,DUM3,XL,
                          CSL,SNL,B
```

COMMON Blocks: /CONSTN/

SUBROUTINE ESFIT

Argument Declarations:

```
OPTDEP - REAL Vector (Len = Unspecified) (Input) - Optical depth due to
           molecular band absorption
ALPHAD - REAL Vector (Len = Unspecified) (Input) - Line width divided by
           the line spacing
NMOLEC - INTEGER Variable (Input) - Number of molecules
EXPBND - REAL Variable (Input) - Optical depth due to exponential terms in
           the band model (i.e., aerosols, hydrometeors, continuum, certain
           molecules)
AFIT   - REAL Vector (Len = unspecified) (Output) - Linear coefficients for
           the exponential sum fit
XKFIT  - REAL Vector (Len = unspecified) (Output) - Exponential coefficients
           for the exponential sum fit
NFIT   - INTEGER Variable (Output) - Number of terms for the exponential sum
           fit
```

PARAMETER Declarations:

```
      INTEGER           ISMX,MOLMAX
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DBLE,EXP,SQRT
      EXTERNAL          LAGRBD
```

Local Variable Declarations:

```
      INTEGER           K,M
      REAL              SUMA,TWGP,AFITM,SUMXK
      DOUBLE PRECISION BETA,FM,XLG,WLGEX
```

COMMON Blocks: /CONSTN/,/LAGUER/,/LOWMSC/

REAL FUNCTION EVAPOR

Argument Declarations:

T - REAL Variable - Temperature (K)

PARAMETER Declarations:

```
      INTEGER          NPTS
      PARAMETER        (NPTS=18)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      EXTERNAL         XTERP
```

Local Variable Declarations:

```
      INTEGER          ITRP0
      REAL             XLATNT(NPTS),TEMP(NPTS)
```

COMMON Blocks: None

LOGICAL FUNCTION EVEN

Argument Declarations:

I - INTEGER Variable - INTEGER input

Local Variable Declarations:

```
      INTEGER          J
```

COMMON Blocks: None

REAL FUNCTION EXGALS

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})
DV - REAL Variable - Wavenumber increment (cm^{-1})

PARAMETER Declarations:

```
      INTEGER          NPTS
      PARAMETER        (NPTS=7)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP,PLANCK
      EXTERNAL         XTERP,PLANCK
```

Local Variable Declarations:

```
      INTEGER          ITRP0
      REAL             WL(NPTS),RADNC(NPTS),WL0,WLREF
```

COMMON Blocks: /CONSTN/

SUBROUTINE EXOATM

Argument Declarations:

```
  IXOTMP - INTEGER Variable (Input) - Exospheric temperature index
             IXOTMP = 0 implies the standard exospheric temperature (1000 K)
             IXOTMP = 1 implies a user-specified exospheric temperature
             IXOTMP = 2 implies a calculated exospheric temperature
  TINF   - REAL Array (Dim = MATLAT x Unspecified) (Input) - Exospheric
             temperature (K)
  ISEASN - INTEGER Variable (Input) - Seasonal index
             ISEASN = 1 implies summer
             ISEASN = 2 implies winter
             ISEASN = 3 implies spring/fall
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER           MAXLAT,MAXLON,NLUPR,NTEXO
      PARAMETER         (MAXLAT=3, MAXLON=1, NLUPR=8, NTEXO=11)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP,UPPRBD
```

Local Variable Declarations:

```
      INTEGER           I,KK,LL,ITRP0
```

COMMON Blocks: /UPRATM/

REAL FUNCTION EXOTMP

Argument Declarations:

```
  F      - REAL Variable - Instantaneous 10.7-cm solar flux obtained from the
             National Research Council, Ottawa, Canada
             (10^-22 watts/m^2/cycles/sec)
  FBAR   - REAL Variable - Average of F over three 27-day solar rotations
             (10^-22 watts/m^2/cycles/sec)
  AP     - REAL Vector (Len = Unspecified) - Geomagnetic planetary index
             An alternate expression is KP (see equation below)
               KP = 0 implies absolutely quiet geomagnetic activity
               KP = 2 implies average quiet geomagnetic activity
  ISNSPT - INTEGER Variable - Sunspot index
             ISNSPT = 1 implies a sunspot minimum
             ISNSPT = 2 implies average sunspot activity
             ISNSPT = 3 implies a sunspot maximum
  IDAY   - INTEGER Variable - Day of the year (1 = January 1)
  SOLAZ  - REAL Variable - Solar azimuth (South = 0.0) (deg)
  SOLEV  - REAL Variable - Solar elevation (deg)
  XLAT   - REAL Variable - Latitude (+ implies North/- implies South) (deg)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,ABS,SIN,COS,TAN,ATAN,EXP
```

Local Variable Declarations:

```
      INTEGER          ISNSPP,IDAYP
      REAL             A(3),BETA,P,GAM,XLATB,XM,XN,R,T1,X1,X2,X3,AX,
     +                   DUM,HSTAR,TAU,ETA,THETA,FP,FBARP
```

COMMON Blocks: /CONSTN/

SUBROUTINE FILOPN

Argument Declarations:

```
  IFINP  - INTEGER Variable (Input) - Input file number
  IFILE  - INTEGER Variable (Input/Output) - File number
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*4       UPCASE
      CHARACTER*72      IOERR
      EXTERNAL          RDLINE,IOERR,UPCASE
```

Local Variable Declarations:

```
      INTEGER           IOS
      CHARACTER*255     NFILE
```

COMMON Blocks: None

SUBROUTINE FILRT

Argument Declarations:

```
  FILERT - CHARACTER*(*) Variable (Input) - File root
  FILENM - CHARACTER*(*) Vector (Len = Unspecified) (Input) - File names
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         INDEX,LEN
      EXTERNAL          DEVCBD,LCTRIM
```

Local Variable Declarations:

```
      INTEGER           I,IXM
CIBM  CHARACTER*1       SLASH
```

COMMON Blocks: /DEVCNM/

REAL FUNCTION FILTER

Argument Declarations:

```
  ITYPE  - INTEGER Variable - Type of filter response
             ITYPE = 0 implies a square response
             ITYPE = 1 implies a user-defined response
  V      - REAL Variable - Wavenumber (cm-1)
  VI     - REAL Variable - Initial wavenumber for square response (cm-1)
  VF     - REAL Variable - Final wavenumber for square response (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           ITRP0
      REAL              WL0
```

COMMON Blocks: /CONSTN/,/FLTRDT/

SUBROUTINE FLSTAT

Argument Declarations:

```
  FILENM - CHARACTER*(*) Vector (Len = Unspecified) (Input) - File names
  ISMARY - INTEGER Variable (Output) - Summary switch
             ISMARY = 0 implies full calculations desired
             ISMARY = 1 implies a summary of an existing file
             ISMARY = 2 implies a restart of a previous calculation
  FILXST - LOGICAL Variable (Output) - Existence flag for IFATM
  FILXSB - LOGICAL Variable (Output) - Existence flag for IFBCK
  FILXSP - LOGICAL Variable (Output) - Existence flag for IFPLM
  FILXSM - LOGICAL Variable (Output) - Existence flag for IFMSC
  FILXSC - LOGICAL Variable (Output) - Existence flag for IFTRN
  FILXSH - LOGICAL Variable (Output) - Existence flag for IFHTR
  FILXS7 - LOGICAL Variable (Output) - Existence flag for IFTP7
  FILXS8 - LOGICAL Variable (Output) - Existence flag for IFTP8
  FILXSD - LOGICAL Variable (Output) - Existence flag for IFDIS
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*1       UPCASE
      CHARACTER*72      IOERR
      EXTERNAL          DEVCBD,UPCASE,IOERR
```

Local Variable Declarations:

```
      INTEGER           IOS
      CHARACTER*1       RESPON,YES
```

COMMON Blocks: /DEVICE/,/MACHIN/

SUBROUTINE FLUXLW

Argument Declarations:

T - REAL Vector (Len = Unspecified) (Input) - Temperatures (K) vs. pressure
LEV - INTEGER Variable (Input) - Altitude level index
FU - REAL Variable (Output) - Upward diffuse longwave flux (W/m^2) at level LEV
FD - REAL Variable (Output) - Downward diffuse longwave flux (W/m^2) at level LEV
EMRAD - REAL Variable (Input) - Emitted flux from earth (W/m^2)
CLDP - REAL Vector (Len = Unspecified) (Input) - Cloud cover (%)
1 - Low etage
2 - Middle etage
3 - High etage

INTRINSIC and EXTERNAL Declarations:

```
EXTERNAL        BRBNBD
```

Local Variable Declarations:

```
REAL            A,B,C,D,E,AP,BP,CP,AT,BT,CT,DT,ET,
                  ATP,BTP,CTP,CC,CCH,CCL,CH,CL,CM,
                  SIGMA,EMHB,EMHT,EMMB,EMMT,EMLB,EMLT
```

COMMON Blocks: /CLDPAR/,/CLIMAT/,/OMATLW/

SUBROUTINE FRESNL

Argument Declarations:

E1 - COMPLEX Variable (Input) - Dielectric constant of layer that electric field starts in
E2 - COMPLEX Variable (Input) - Dielectric constant of layer that electric field ends up
ANGLE - REAL Variable (Input) - Elevation angle in free space (deg)
RH - COMPLEX Variable (Input) - Horizontally polarized reflectivity
RV - COMPLEX Variable (Input) - Vertically polarized reflectivity
TH - COMPLEX Variable (Input) - Horizontally polarized transmissivity
TV - COMPLEX Variable (Input) - Vertically polarized transmissivity

INTRINSIC and EXTERNAL Declarations:

```
INTRINSIC       COS,CMPLX,SQRT,ABS
```

Local Variable Declarations:

```
COMPLEX         CI,S1,S2
```

COMMON Blocks: /CONSTN/

REAL FUNCTION GALRAD

Argument Declarations:

XL	- REAL Variable -	Galactic azimuth (deg)
B	- REAL Variable -	Galactic elevation (deg)
V	- REAL Variable -	Wavenumber (cm^{-1})
DV	- REAL Variable -	Wavenumber increment (cm^{-1})

INTRINSIC and EXTERNAL Declarations:

```
      REAL              PLANCK
      INTRINSIC         ABS,EXP
      EXTERNAL          PLANCK
```

Local Variable Declarations:

```
      REAL              C(3),C0,T0,AL,PHI
```

COMMON Blocks: /CONSTN/

REAL FUNCTION GAM

Argument Declarations:

R1S	- REAL Variable -	Directional reflection coefficient, layer 1
R2	- REAL Variable -	Diffuse reflection coefficient, layer 2
R2S	- REAL Variable -	Directional reflection coefficient, layer 2
R3	- REAL Variable -	Diffuse reflection coefficient, layer 3
T2	- REAL Variable -	Transmission, layer 2

REAL FUNCTION GAMMLN

Argument Declarations:

X	- REAL Variable -	Argument

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DBLE,LOG
```

Local Variable Declarations:

```
      INTEGER           I
      DOUBLE PRECISION A(6),STP,FPF,TMP,SUM,DXINC,DX
```

COMMON Blocks: None

SUBROUTINE GBLBCK

Argument Declarations:

```
  XLATIT - REAL Variable (Input) - Latitude (deg)
               implies Northern hemisphere
             - implies Southern hemisphere
  XLONG  - REAL Variable (Input) - Longitude (deg)
               implies Western hemisphere
             - implies Eastern hemisphere
  MONTH  - INTEGER Variable (Input) - Month index (1 = Jan)
  HOUR   - REAL Variable (Input) - Time of day (LST) (dec. hr.)
  ISCENE - INTEGER Variable (Output) - Scene index
  ALTIT  - REAL Variable (Input/Output) - Altitude (km)
  TSURF  - REAL Variable (Input/Output) - Surface temperature (K)
  CLDCVR - REAL Vector (Len = Unspecified) (Output) - Cloud cover (%)
             0 - Total
             1 - Low etage
             2 - Middle etage
             3 - High etage
  TMIDN  - REAL Variable (Output) - Air temperature at midnight (K)
  TNOON  - REAL Variable (Output) - Air temperature at noon (K)
  FRSNW  - REAL Variable (Output) - Percentage snow (%)
  FRICE  - REAL Variable (Output) - Percentage ice (%)
  FRWTR  - REAL Variable (Output) - Percentage water (%)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              AIRTMP
      INTRINSIC         REAL,INT,MAX,MIN,MOD,ABS,SIGN
      EXTERNAL          AIRTMP,RDGBL,RDSCN,ATMSBD,DEVCBD
```

Local Variable Declarations:

```
      REAL              FAC,GMT(2,2),TSRF(2),CLCV(2,0:3,2),ALT
                          CLDRAD(2,3,2),CIRR,HOUR0,TAIR0
```

COMMON Blocks: None

SUBROUTINE GEOM

Argument Declarations:

```
  L1      - INTEGER Variable (Input) - Indicates location in profile
              array of initial point of path
  L2      - INTEGER Variable (Input/Output) - Indicates location in
              profile array of final point of path
  SLRNG   - REAL Variable (Input) - Slant range (km)
  BETA    - REAL Variable (Input) - Earth center angle (deg)
  PHI1    - REAL Variable (Input) - Elevation angle at point L1 (rad)
  PHI2    - REAL Variable (Input) - Elevation angle at point L2 (rad)
  LENP    - INTEGER Variable (Input) - Index for the type of path in
              case of any ambiguity
                LENP = 0 implies shorter path
                LENP = 1 implies longer path
  ITPGM   - INTEGER Variable (Input) - Index for the type of geometry
  R       - REAL Vector (Len = Unspecified) (Output) - Distances
              between initial point of path and intermediate points
              along path (km)
  PHI     - REAL Vector (Len = Unspecified) (Output) - Elevation angles
              at intermediate points along path (rad)
  THETA   - REAL Vector (Len = Unspecified) (Output) - Earth center
              angles at intermediate points along path (rad)
  IZ      - INTEGER Vector (Len = Unspecified) (Output) - Location in
              altitude grid of intermediate points along path
  LYR     - INTEGER Variable (Output) - DIMENSION of R, PHI, THETA, and IZ
  LYRMAX  - INTEGER Variable (Input) - Maximum allowed DIMENSION of R,
              PHI, THETA, and IZ
  IBKGD   - INTEGER Variable (Input/Output) - Type of background
  RHOS    - REAL Variable (Input) - Slant range from L1 to tangent point at
              L2 (km)
  BHOS    - REAL Variable (Input) - Earth-center angle from L1 to tangent
              point at L2 (rad)
  PHOS    - REAL Variable (Input) - Elevation angle at L1 for L2 to be at
              the tangent point (rad)
  SRMAX   - REAL Variable (Input) - Maximum slant range between L1 and L2 (km)
  BETMAX  - REAL Variable (Input) - Maximum earth center angle between L1
              and L2 (deg)
  IWARN   - INTEGER Variable (Input) - Convergence warning printout switch
              IWARN = 0 implies no convergence warning message printed
              IWARN = 1 implies convergence warning message printed
  IERR    - INTEGER Variable (Output) - Error switch
              IERR = -1 implies fatal errors in geometry
              IERR =  0 implies no errors in geometry
              IERR =  1 implies warning in geometry
  HTNGT   - REAL Variable (Input/Output) - Tangent altitude (km)
  HSEND   - REAL Variable (Input/Output) - End point altitude (km)
  NLAT    - INTEGER Variable (Input) - Number of latitudes
  NLON    - INTEGER Variable (Input) - Number of longitudes
  FLIMB   - LOGICAL Variable (Input) - Logical flag for limb paths
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,MOLMAX
      PARAMETER        (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MAXLAT=3, MAXLON=1, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        ABS,REAL,DBLE,INT,SIGN
      EXTERNAL         RAYPTH,INIGEO,ENDPT
```

SUBROUTINE GEOM (continued)

Local Variable Declarations:

```
      INTEGER           I,J,ITER,LP,MLP,JBKGD,IDRCT,ISET(2),LLP,JTPGM,
                          LENPP,LPP
      REAL              VAR(3),FAC(3),EPSR,VAR0,DUM,ALTMAX
      DOUBLE PRECISION  PHID,P(3)
      LOGICAL           FLVAR,FLPHI1,FLPHI2
```

COMMON Blocks: /CONSTN/,/INITAL/

SUBROUTINE GETASP

Argument Declarations:

ISHINE - INTEGER Variable (Output) - Sky/earthshine index

PARAMETER Declarations:

```
      INTEGER           MLMAX,NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,
                          ISMX,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NVSMAX=20)
      PARAMETER         (MAXLAT=3, MAXLON=1, MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT
      CHARACTER*1       UPCASE
      INTRINSIC         MAX
      EXTERNAL          IGTINT,GETVEC,RDLINE,DEVCBD,UPCASE
```

Local Variable Declarations:

```
      INTEGER           NAZDUM,MM
      REAL              AZDUM(NZSMAX)
      CHARACTER*1       ACTION,YES
      CHARACTER*255     VARIAB,VARS1,VARS2,VARS3
```

COMMON Blocks: /DEVICE/,/HEADER/,/USERDF/

SUBROUTINE GETATM

Argument Declarations:

ITYPE - INTEGER Variable (Output) - Latitude index

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT,NCHATM,NCHAER,NCHSEA,NCHAZE
      REAL              GETVAR
      CHARACTER*1       UPCASE
      CHARACTER*4       LWCASE
      INTRINSIC         MAX
      EXTERNAL          GETVAR,DEVCBD,IGTINT,RDLINE,NCHATM,LWCASE,
                          NCHAER,NCHSEA,NCHAZE,UPCASE,IGTVEC,MRNDFL
```

Local Variable Declarations:

```
      INTEGER           K,NMX,KK,LL
      REAL              ELPST,RADON
      CHARACTER*1       ACTION,YES
      CHARACTER*255     VARIAB,VARS1,VARS2,VARS3
```

COMMON Blocks: /DEVICE/,/HEADER/

SUBROUTINE GETBCK

Argument Declarations:

HXTRA - REAL Vector (Len = Unspecified) (Input/Output) - Extra altitude array (km)
NXTRA - INTEGER Variable (Input/Output) - Number of extra altitudes

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,NMATL,MAXLAT,MAXLON,
                          ISMX,NVSMAX,NSCEN,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NMATL=28, NSCEN=35)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT
      REAL              GETVAR
      CHARACTER*1       UPCASE
      INTRINSIC         MAX
      EXTERNAL          RDLINE,GETVAR,IGTINT,DEVCBD,USRBCK,UPCASE,
                          GETVEC,BKGDBD
```

Local Variable Declarations:

```
      INTEGER           L,KK,LL,NCLDCV,NPT3,NCLALB,NCLALT
      REAL              DELH
      CHARACTER*255     VARIAB
```

COMMON Blocks: /BACKGD/,/DEVICE/,/HEADER/

SUBROUTINE GETCLD

Argument Declarations:

```
  HXTRA  - REAL Vector (Len = Unspecified) (Output) - Extra altitudes for
             profile grid (km)
  NXTRA  - INTEGER Variable (Output) - Number of extra altitudes
  HCLDBS - REAL Variable (Output) - Cloud base altitude (km)
  DELCLD - REAL Variable (Output) - Cloud thickness (km)
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT
      REAL              GETVAR
      CHARACTER*1       UPCASE
      EXTERNAL          GETVAR,IGTINT,RDLINE,DEVCBD,USRCLD,UPCASE
```

Local Variable Declarations:

```
      INTEGER           L
      REAL              CLDBSU,CLDTPU
      CHARACTER*1       ACTION,YES
      CHARACTER*2       CTYPE
      CHARACTER*255     VARIAB,VARS1,VARS2,VARS3,VARS4
```

COMMON Blocks: /CLDRN/ ,/DEVICE/,/HEADER/

SUBROUTINE GETEXO

Argument Declarations:

IFINP - INTEGER Variable (Input) - Input file number
F - REAL Variable (Output) - Instantaneous 10.7-cm solar flux obtained from the National Research Council, Ottawa, Canada (10^{-22} watts/m^2/cycles/sec)
FBAR - REAL Variable (Output) - Average of F over three 27-day solar rotations (10^{-22} watts/m^2/cycles/sec)
IXOTMP - INTEGER Variable (Output) - Exospheric temperature index
IXOTMP = 0 implies the standard exospheric temperature (1000 K)
IXOTMP = 1 implies a user-specified exospheric temperature
IXOTMP = 2 implies a calculated exospheric temperature
FLEXO - LOGICAL Variable (Output) - Exoatmospheric temperature calculation flag
AP - REAL Vector (Len = Unspecified) (Output) - Geomagnetic planetary index
Note: Low value Ap = 3.
Moderate value Ap = 15.
High value Ap = 75.

AP(1): Daily Ap index
AP(2): 3 hr Ap index for CURRENT TIME
AP(3): 3 hr Ap index for 3 hrs before current time
AP(4): 3 hr Ap index for 6 hrs before current time
AP(5): 3 hr Ap index for 9 hrs before current time
AP(6): Average of eight 3 hr Ap indicies from 12 to 33 hrs prior to current time
AP(7): Average of eight 3 hr Ap indicies from 36 to 59 hrs prior to current time

ISNSPT - INTEGER Variable (Output) - Sunspot index
ISNSPT = 1 implies a sunspot minimum
ISNSPT = 2 implies average sunspot activity
ISNSPT = 3 implies a sunspot maximum
TINF0 - REAL Variable (Output) - Specified value of exoatmospheric temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
INTEGER          IGTINT
REAL             GETVAR
CHARACTER*1      UPCASE
EXTERNAL         GETVAR,DEVCBD,RDLINE,IGTINT,UPCASE,PARSE
```

Local Variable Declarations:

```
INTEGER          I,NAP
CHARACTER*1      ACTION
CHARACTER*20     VARS(7)
CHARACTER*255    VARIAB,VARS1
```

COMMON Blocks: None

SUBROUTINE GETGLC

Argument Declarations:

```
  INDX   - INTEGER Variable (Input) - Index for number of coefficients
  XMU    - DOUBLE PRECISION Vector (Len = Unspecified) (Output) -
             Gauss-Legendre abscissa values
  WT     - DOUBLE PRECISION Vector (Len = Unspecified) (Output) -
             Gauss-Legendre weights
  N      - INTEGER Variable (Output) - Number of coefficients
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          GLCFBD
```

Local Variable Declarations:

```
      INTEGER           M,I,IP
```

COMMON Blocks: /GAUSSL/

SUBROUTINE GETPOS

Argument Declarations:

```
  XLAT   - REAL Variable (Output) - Latitude (+ North/- South) (deg)
  XLONG  - REAL Variable (Output) - Longitude (+ East/- West) (deg)
  IDAY   - INTEGER Variable (Output) - Day of the month
  IMONTH - INTEGER Variable (Output) - Month of the year
  IYEAR  - INTEGER Variable (Output) - Year
  TIME   - REAL Variable (Output) - Time (HH.MMSSS)
  ITIME  - INTEGER Variable (Output) - Time index
             ITIME = 0 implies Local Standard Time
             ITIME = 1 implies Greenwich Mean Time
             ITIME = 2 implies Local Daylight Savings Time
  ICOREF - INTEGER Variable (Output) - Coordinate reference index
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT,MONTH
      REAL              GETVAR
      CHARACTER*1       LWCASE
      CHARACTER*3       UPCASE
      INTRINSIC         REAL,INT,ABS,MOD,INDEX,LEN
      EXTERNAL          GETVAR,DEVCBD,IGTINT,RDLINE,MONTH,CALEND,
                          LWCASE,UPCASE,CHTIME
```

Local Variable Declarations:

```
      INTEGER           IHR,IMN,IDAYX,ITYP1,ICH,ICM,LN
      REAL              XMIN,SEC,YEAR
      CHARACTER*255     VARIAB
```

COMMON Blocks: /DEVICE/

SUBROUTINE GETSLR

Argument Declarations:

```
ISOLAR - INTEGER Variable (Output) - Solar index
ISMPLS - INTEGER Variable (Output) - Type of solar calculation
SOLEV  - REAL Variable (Output) - Solar elevation (deg)
SOLAZ  - REAL Variable (Output) - Solar azimuth (deg)
SOLDIS - REAL Variable (Output) - Relative solar distance
XLATSL - REAL Variable (Output) - Sub-solar point latitude (deg)
XLONSL - REAL Variable (Output) - Sub-solar point longitude (deg)
ILUNAR - INTEGER Variable (Output) - Lunar index
ISMPLL - INTEGER Variable (Output) - Type of lunar calculations
XLUNEV - REAL Variable (Output) - Lunar elevation (deg)
XLUNAZ - REAL Variable (Output) - Lunar azimuth (deg)
PHLUNR - REAL Variable (Output) - Lunar phase (deg)
XLNDIS - REAL Variable (Output) - Relative lunar distance
XLATLN - REAL Variable (Output) - Sub-lunar point latitude (deg)
XLONLN - REAL Variable (Output) - Sub-lunar point longitude (deg)
ISLANG - INTEGER Variable (Output) - Elevation/zenith angle index
ISLPOS - INTEGER Variable (Output) - Position index
IEPHEM - INTEGER Variable (Output) - Ephemeris index
XLAT   - REAL Variable (Input) - Reference latitude (deg)
XLON   - REAL Variable (Input) - Reference longitude (deg)
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GETVAR
      CHARACTER*1       UPCASE
      INTRINSIC         ACOS,COS,ABS,SIGN,ATAN2,TAN,SIN,REAL,DBLE
      EXTERNAL          GETVAR,DEVCBD,RDLINE,SPTRIG,UPCASE
```

Local Variable Declarations:

```
      INTEGER           I
      REAL              BETA,XSLR(3),XLNR(3),DOTPR
      DOUBLE PRECISION  RSOLAR,RLUNAR,RE
      CHARACTER*2       ACTION
      CHARACTER*255     VARIAB,VARS1,VARS2,VARS3,VARS4,VARS5,VARS6,
                          VARS7
```

COMMON Blocks: /CONSTN/,/DEVICE/

REAL FUNCTION GETVAR

Argument Declarations:

VARIAB - CHARACTER*(*) Variable - Input string

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INDEX,LEN
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER         ICNT,IOS
      REAL            DEFALT
      CHARACTER*7     FMTSTR
```

COMMON Blocks: None

SUBROUTINE GETVEC

Argument Declarations:

```
VARIAB - CHARACTER*(*) Variable (Input) - Input string
X      - REAL Vector (Len = Unspecified) (Output) - Vector string
N      - INTEGER Variable (Output) - Length of vector string
NMAX   - INTEGER Variable (Input) - Maximum length of vector string
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           LENSTR
      CHARACTER*72      IOERR
      EXTERNAL          IOERR,LENSTR,LCTRIM
```

Local Variable Declarations:

```
      INTEGER         I,IM,IP,LNMAX,ISW,IOS
      REAL            DEFALT
      CHARACTER*7     FMTSTR
```

COMMON Blocks: None

SUBROUTINE H2OCNT

Argument Declarations:

```
V      - REAL Variable (Input) - Wavenumber (cm-1)
T      - REAL Variable (Input) - Temperature (K)
SH2O   - REAL Variable (Output) - Self-broadened coefficient
FH2O   - REAL Variable (Output) - Foreign-broadened coefficient
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX,MIN,INT,REAL,TANH,EXP
      EXTERNAL         H2OBD
```

Local Variable Declarations:

```
      INTEGER          I,N,NP
      REAL             SBCOEF(2),XI,FAC,RADFN,FBCOEF,FDG
```

COMMON Blocks: /CONTNS/

REAL FUNCTION HAZE

Argument Declarations:

```
H      - REAL Variable - Altitude (km)
IHAZE  - INTEGER Variable - Index for haze profiles
ISEASN - INTEGER Variable - Index for season
IUPPER - INTEGER Variable - Index for upper atmosphere profile
VIS    - REAL Variable - Sea-level visible range (km)
ZVSA   - REAL Vector (Len = Unspecified) - Altitude array for vertical
           structure (km)
ZVSAMX - REAL Variable - Maximum altitude for which vertical structure is
           valid (km)
HZVSA  - REAL Vector (Len = Unspecified) - Extinction coefficients for the
           vertical structure (km-1)
HBCK   - REAL Variable - Altitude of the terrain (km)
HTRO   - REAL Variable - Altitude of the tropopause (km)
HSTR   - REAL Variable - Altitude of the stratopause (km)
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,NASMAX,NGMAX,NVSA,NZBNDR,NZTROP,
                         NZSTRA,NZUPR,ISMX,MOLMAX
      PARAMETER        (MLMAX=140, NASMAX=15, NGMAX=15)
      PARAMETER        (NVSA=9, NZBNDR=3, NZTROP=9, NZSTRA=17)
      PARAMETER        (NZUPR=14, MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP,HLOWT
      INTRINSIC        MAX
      EXTERNAL         XTERP,HAZEBD,HLOWT
```

Local Variable Declarations:

```
      INTEGER          ITRP0,I,N,NUPPER,IHZ,ITRP1
      REAL             H1,H2,H3,H4,FACV,AHZ1,AHZ2,FACH,HP,HL,HB2,HTRL,
                         HSTL
```

COMMON Blocks: /FLAGS/,/HZDATA/,/USERDF/

REAL FUNCTION HEYMS

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS,EXP,MAX,MIN
```

Local Variables

```
      REAL              TC
```

COMMON Blocks: None

REAL FUNCTION HLOWT

Argument Declarations:

ALT - REAL Variable - Altitude (km)
HBCK - REAL Variable - Terrain altitude (km)

Local Variable Declarations:

```
      REAL              HREF
```

COMMON Blocks: None

SUBROUTINE HOREQU

Argument Declarations:

AZ - REAL Variable (Input) - Azimuthal direction (deg)
North is 0.0 degrees
EL - REAL Variable (Input) - Elevation angle (deg)
XLATIT - REAL Variable (Input) - Latitude (deg)
TIME - REAL Variable (Input) - Sidereal time (deg)
ALPHA - REAL Variable (Output) - Equatorial azimuth (deg)
DELTA - REAL Variable (Output) - Equatorial elevation (deg)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SIN,COS,ATAN2,ABS
```

Local Variable Declarations:

```
      REAL              CSA,SNA,CSE,SNE,CSL,SNL,DUM1,DUM2,DUM3,T,CST,
                        SNT,D
```

```
COMMON Blocks:          /CONSTN/
```

SUBROUTINE HORIZN

Argument Declarations:

```
  L1      - INTEGER Variable (Input) - Initial altitude index
  L2      - INTEGER Variable (Input) - Final altitude index
  LBKGD   - INTEGER Variable (Input) - Background altitude index
  SLRNG   - REAL Variable (Input) - Slant range (km)
  BETA    - REAL Variable (Input) - Earth center angle (deg)
  LENP    - INTEGER Variable (Output) - Short/long path index
  PHOS    - REAL Variable (Output) - Horizon elevation angle (rad)
  RHOS    - REAL Variable (Output) - Horizon slant range (km)
  BHOS    - REAL Variable (Output) - Horizon earth center angle (rad)
  SRMAX   - REAL Variable (Output) - Maximum slant range (km)
  BETMAX  - REAL Variable (Output) - Maximum earth center angle (deg)
  IBKGD   - INTEGER Variable (Input) - Background index
  IERR    - INTEGER Variable (Output) - Error switch
              IERR = -1 implies fatal errors in geometry
              IERR =  0 implies no errors in geometry
  IPRINT  - INTEGER Variable (Input) - Print switch for warning message
  NLAT    - INTEGER Variable (Input) - Number of latitudes
  NLON    - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          RAYPTH
```

Local Variable Declarations:

```
      INTEGER           IOSB(MLMX2),KL,LX,LY,LEN0,JBKGD
      REAL              R(MLMX2),PHI(MLMX2),THETA(MLMX2),RHR,BHR,RHT,
                          BHT,HTNGT
      DOUBLE PRECISION  PHI0
```

COMMON Blocks: /CONSTN/

SUBROUTINE HTBLNC

Argument Declarations:

```
  RFDSP  - REAL Variable (Input) - Direct solar flux at T=0 (W/m²)
  RFDS   - REAL Variable (Input) - Direct solar flux at T=DELTIM (W/m²)
  ABSSLR - REAL Variable (Input) - Solar absorptivity
  EMSTRM - REAL Variable (Input) - Thermal emissivity
  HTCLYR - REAL Vector (Len = 0:Unspecified) (Input) - Conductance
             coefficient (W/m²/K)
  CHARLN - REAL Variable (Input) - Surface characteristic length (m)
  SPHLYR - REAL Vector (Len = 0:Unspecified) (Input) - Specific heat
             (W-sec/gm/K)
  DENLYR - REAL Vector (Len = 0:Unspecified) (Input) - Density (gm/m³)
  DELTIM - REAL Variable (Input) - Time increment (dec. hour)
  TAIRLP - REAL Variable (Input) - Local air temperature at T=0 (K)
  TAIRLC - REAL Variable (Input) - Local air temperature at T=DELTIM (K)
  PRESSP - REAL Variable (Input) - Local air pressure at T=0 (mb)
  PRESS  - REAL Variable (Input) - Local air pressure at T=DELTIM (mb)
  WINDTP - REAL Variable (Input) - Wind speed at T=0 (m/sec)
  WINDT  - REAL Variable (Input) - Wind speed at T=DELTIM (m/sec)
  DSWP   - REAL Variable (Input) - Downward short-wave flux at T=0 (W/m²)
  DSW    - REAL Variable (Input) - Downward short-wave flux at T=DELTIM (W/m²)
  DLWP   - REAL Variable (Input) - Downward long-wave flux at T=0 (W/m²)
  DLW    - REAL Variable (Input) - Downward long-wave flux at T=DELTIM (W/m²)
  TLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) - Temperatures in
             conducting subsurface (K)
  ZLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) - Layer depth (m)
  NLAYER - INTEGER Variable (Input) - Number of layers
  IHTFLG - INTEGER Variable (Input) - Heat calculation index
             IHTFLG = 0 implies no heat calculations
             IHTFLG = 1 implies heat calculations with evaporation
             IHTFLG = 2 implies heat calculations without evaporation
  DUMLYR - REAL Array (Dim = 2 x Unspecified) (Input) - Dummy value
             for each layer moved outside of routine for efficiency
  ZSRILR - REAL Variable (Input) - Surface material thickness (m)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,MIN,ABS,EXP
      EXTERNAL          SRFLUX
```

Local Variable Declarations:

```
      INTEGER           L,NTIME,ITM,NCYCLE,NCYCMX,NTIMIN
      REAL              FAC,RFDST,TAIRT,PRESST,WINDTT,DSWT,DLWT,DELTS,
                          B,C,DTIMIN,DTEMP,TEMP(0:21),H,TS,ALPH,PERIOD
```

COMMON Blocks: /CONSTN/

SUBROUTINE HYDROM

Argument Declarations:

L - INTEGER Variable (Input) - Altitude index
ICLOUD - INTEGER Variable (Input) - Cloud index
ICLDRN - INTEGER Variable (Input) - Cloud and rain index
EXTCLD - REAL Variable (Output) - Extinction coefficient in cloud (km^{-1})
EXTICE - REAL Variable (Output) - Extinction coefficient for ice clouds (km^{-1})
ICIRUS - INTEGER Variable (Input) - Cirrus cloud index
HCIRBS - REAL Variable (Input) - Cirrus base altitude (km)
DELCIR - REAL Variable (Input) - Cirrus thickness (km)
CIRICE - REAL Variable (Input) - Cirrus equivalent liquid water content (gm/m^3)
EXTCIR - REAL Variable (Input/Output) - Extinction coefficient for cirrus (km^{-1})
IRAIN - INTEGER Variable (Input) - Rain index
EXTRN - REAL Variable (Output) - Extinction coefficient for rain (km^{-1})
ISNOW - INTEGER Variable (Input) - Snow type index
EXTSN - REAL Variable (Output) - Extinction coefficient for snow (km^{-1})
TEMP - REAL Variable (Input) - Temperature (K)
NLAT - INTEGER Variable (Input) - Number of latitudes
NLON - INTEGER Variable (Input) - Number of longitudes

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,NWLAER,NWLCLD,NANG,MAXLAT,MAXLON,
                          NGMAX,MOLMAX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RAINEX,SNOWEX,SATUR,XTERP,CIREX
      INTRINSIC         MIN
      EXTERNAL          RAINEX,SNOWEX,SATUR,CLDRBD,XTERP,PROFAC,CIREX,
                          ARSABD,ARSLBD,ARSXBD
```

Local Variable Declarations:

```
      INTEGER           I,ICLAER,IC,KTPW,KTPPW,KTPI,KTPPI,KK,LL,ITRP0,
                          ITYPE
      REAL              FACTW,FACTI
```

COMMON Blocks: /AEROSL/,/AERSCC/,/AERSLA/,/AERSLX/,/CLDRN/ , /CLDUSR/,/INITAL/

INTEGER FUNCTION IBKCNV

Argument Declarations:

ISCENE - INTEGER Variable - Ecosystem index

Local Variable Declarations: None

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          ECOSBD
```

COMMON Blocks: /ECOCNV/

INTEGER FUNCTION IBNSRC

Argument Declarations:

```
  X0      - REAL Variable - Value of X for which location is to be found
  X       - REAL Vector (Len = Unspecified) - X-array (must be monotonic and
              either increasing or decreasing)
  N       - INTEGER Variable - DIMENSION of X-array
  KEY     - INTEGER Variable - Position in X-array for which search for
              adjacent points to the X0-value starts
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MAX,MIN,REAL,ABS,INT
```

Local Variable Declarations:

```
      INTEGER           I,M,M1,M2
      REAL              FAC
```

COMMON Blocks: None

INTEGER FUNCTION IDAERO

Argument Declarations:

```
  IBKGD   - INTEGER Variable - Terrain background index
  HBCK    - REAL Variable - Terrain altitude (km)
```

Local Variable Declarations:

```
      INTEGER           IAER(-4:63)
```

COMMON Blocks: None

INTEGER FUNCTION IGTINT

Argument Declarations:

```
  VARIAB - CHARACTER*(*) Variable - Input string
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INDEX,LEN
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER         ICNT,IOS,IDFALT
      CHARACTER*5     FMTSTR
```

COMMON Blocks: None

SUBROUTINE IGTVEC

Argument Declarations:

```
VARIAB - CHARACTER*(*) Variable (Input) - Input string
ISTR   - INTEGER Vector (Len = N) (Output) - Vector string
N      - INTEGER Variable (Output) - Length of vector string
NMAX   - INTEGER Variable (Input) - Maximum length of vector string
```

INTRINSIC and EXTERNAL Declarations:

```
INTEGER          LENSTR
CHARACTER*72     IOERR
EXTERNAL         IOERR,LENSTR
```

Local Variable Declarations:

```
INTEGER          I,IP,IM,LNMAX,ISW,IOS,IDFALT
CHARACTER*5      FMTSTR
```

COMMON Blocks: None

COMPLEX FUNCTION INDEXI

Argument Declarations:

```
WL     - REAL Variable - Wavelength (μm)
TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
REAL             XTERP
INTRINSIC        CMPLX
EXTERNAL         XTERP,ICEBD
```

Local Variable Declarations:

```
INTEGER          I,ITRP0
REAL             EMW,EMWT(4),CAYW,CAYWT(4)
```

COMMON Blocks: /ICEREF/

COMPLEX FUNCTION INDEXW

Argument Declarations:

```
  WL      - REAL Variable - Wavelength (μm)
  TEMP    - REAL Variable - Temperature (K)
```

PARAMETER Declarations:

```
      INTEGER           NWLWTR,NFRQ
      PARAMETER         (NWLWTR=169, NFRQ=28)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         CMPLX,SQRT
      EXTERNAL          XTERP,WTRBD
```

Local Variable Declarations:

```
      INTEGER           ITRP0
      REAL              EMW,CAYW,DIELR,DIELI,ES,RLS,EW,EINF,V,FREQ
```

COMMON Blocks: /INDXWR/

SUBROUTINE INDXBK

Argument Declarations:

```
  IBKGD  - INTEGER Variable (Input) - Scene/Background index
  MONTH  - INTEGER Variable (Input) - Month index (1 = Jan)
  HOUR   - REAL Variable (Input) - Time of day (LST) (dec. hr.)
  XLAT   - REAL Variable (Input) - Latitude (deg.)
  XLON   - REAL Variable (Input) - Longitude (deg.)
  TAIR   - REAL Variable (Input/Output) - Surface air temperature (K)
  CLDCVR - REAL Vector (Len = Unspecified) (Output) - Cloud cover
             0 - Total
             1 - Low etage
             2 - Middle etage
             3 - High etage
  ISCENE - INTEGER Variable (Output) - Scene index
  TMIDN  - REAL Variable (Output) - Air temperature at midnight (K)
  TNOON  - REAL Variable (Output) - Air temperature at noon (K)
  TPROF  - REAL Variable (Input) - Profile temperature (K)
  FRSNW  - REAL Variable (Output) - Percentage snow (%)
  FRICE  - REAL Variable (Output) - Percentage ice (%)
  FRWTR  - REAL Variable (Output) - Percentage water (%)
```

PARAMETER Declarations:

```
      INTEGER           NSCEN
      PARAMETER         (NSCEN=35)
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          GBLBCK
```

Local Variable Declarations:

```
      REAL              ALTIT
```

COMMON Blocks: None

INTEGER FUNCTION INDXSC

Argument Declarations:

ISCENE - INTEGER Variable - Scene/Background index

Local Variable Declarations: None

COMMON Blocks: None

SUBROUTINE INICPL

Argument Declarations:

NPTS - INTEGER Variable (Output) - Number of points in exponential sum fit
NMOLEC - INTEGER Variable (Input) - Number of molecules

PARAMETER Declarations:

```
      INTEGER          MLMAX,NBAND,ISMX,NANG,MAXLAT,MAXLON,NGMAX,
                         NAZMAX,NASMAX,NZSMAX,NVSMAX,MOLMAX
      PARAMETER        (MLMAX=140, NBAND=16, NANG=65)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             BETA,BETAU
      INTRINSIC        SIN,ABS,MAX,MIN
      EXTERNAL         ESFIT,UDLAY,BETA,BETAU,SRTLAY
```

Local Variable Declarations:

```
      INTEGER          I,K,L,LM,LP,KK,LL
      REAL             OPDPTH(ISMX),OPTI,ALBI,ALPHAD(ISMX),B,BUS,BUL,
                         DZ,PS,TS,P0,T0,EXPDEP,XMU0S,XMU0L,SCTDEP
```

```
COMMON Blocks:         /ARSLSC/,/CONSTN/,/FLAGS/,/HEADER/,/INITAL/,
                         /LYRSTO/,/MSPARM/,/PRBNDA/,/PRBNDB/
```

SUBROUTINE INIGEO

Argument Declarations:

```
  L1      - INTEGER Variable (Input) - Indicates location in profile
              array of initial point of path
  L2      - INTEGER Variable (Input) - Indicates location in profile
              array of final point of path
  SLRNG   - REAL Variable (Input) - Slant range (km)
  BETA    - REAL Variable (Input) - Earth center angle (deg)
  PHI1    - REAL Variable (Input) - Elevation angle at point L1 (rad)
  PHI2    - REAL Variable (Input) - Elevation angle at point L2 (rad)
  LENP    - INTEGER Variable (Input) - Index for the type of path in case
              of any ambiguity
                LENP = 0 implies shorter path
                LENP = 1 implies longer path
  RHOS    - REAL Variable (Input) - Slant range from L1 to tangent point at
              L2 (km)
  BHOS    - REAL Variable (Input) - Earth-center angle from L1 to tangent
              point at L2 (rad)
  PHOS    - REAL Variable (Input) - Elevation angle at L1 for L2 to be at
              the tangent point (rad)
  SRMAX   - REAL Variable (Input) - Maximum slant range between L1 and
              L2 (km)
  BETMAX  - REAL Variable (Input) - Maximum earth center angle
              between L1 and L2 (deg)
  P       - DOUBLE PRECISION Vector (Len = Unspecified) (Output) - Source
              elevation angles for ray path.  Three values correspond to an
              upper limit, a lower limit, and the best estimate value (rad)
  VAR     - REAL Vector (Len = Unspecified) (Output) - Either slant or earth
              center angle or source elevation angle corresponding to the
              three values of P (km or deg or rad)
  VAR0    - REAL Variable (Output) - Either slant or earth center angle
              corresponding to the input value (km or deg)
  JTPGM   - INTEGER Variable (Input) - Index for type of geometry
              JTPGM = 1 implies the slant range is defined
              JTPGM = 2 implies the earth center angle is defined
              JTPGM = 3 implies the source elevation angle is defined
              JTPGM = 4 implies the observer elevation angle is defined
  IERR    - INTEGER Variable (Output) - Error switch
              IERR = -1 implies fatal errors in geometry
              IERR =  0 implies no errors in geometry
              IERR =  1 implies warning in geometry
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,NAZMAX,NASMAX,
                          NZSMAX,NVSMAX,MOLMAX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         COS,SIN,ACOS,ASIN,ABS,ATAN2,MAX,MIN,DBLE,REAL,
                          SIGN
```

Local Variable Declarations:

```
      INTEGER           KK,LL
      REAL              DELH,VAR0,G,RH1,RH2,FAC(3),XMHAV1,XMHAV2,
                          XMHAVB,ATMFAC(MAXLAT,MAXLON)
      DOUBLE PRECISION R1,R2,DR2,XR,MHP1,MHPB,PMIN,PMAX
```

COMMON Blocks: /CONSTN/,/HEADER/,/INITAL/

SUBROUTINE INITL

Argument Declarations:

```
  LENP   - INTEGER Vector (Len = Unspecified) (Output) - Index for short or
             long path.  Only needed when an ambiguity exists.
  ISHINE - INTEGER Vector (Len = Unspecified) (Output) - Sky/earthshine index
  HXTRA  - REAL Vector (Len = Unspecified) (Output) - Extra altitudes for
             profile grid (km)
  NXTRA  - INTEGER Variable (Output) - Number of extra altitudes
  NXMAX  - INTEGER Variable (Input) - Dimension of HXTRA
  HEADNG - CHARACTER*(*) Variable (Output) - User-defined heading
  FILERT - CHARACTER*(*) Variable (Input) - File root
  IFLTR  - INTEGER Variable (Input) - Filter index
  ISMARY - INTEGER Variable (Output) - Summary index
  ISLPOS - INTEGER Variable (Output) - Solar/lunar position index
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,NAZMAX,NASMAX,NGMAX,NZSMAX,NANTMX,
                          MAXLAT,MAXLON,NL,NMATL,NVSMAX,NVSA,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8, NVSA=9)
      PARAMETER         (NANTMX=25)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (NL=50)
      PARAMETER         (NMATL=28)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           MDLATM
      REAL              GETVAR,EXOTMP
      CHARACTER*1       UPCASE
      CHARACTER*3       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         MIN,REAL,SIGN,ATAN2,ACOS,COS,SIN,TAN,MOD,AINT,
                          ABS,MAX,INT
      EXTERNAL          DFLT8,GETVAR,GETVEC,SETFLG,ISRAEL,DEVCBD,VSA,
                          GETSLR,RDLINE,GETATM,GETCLD,GETBCK,MDLATM,
                          CALEND,USRDEF,GETPOS,PARSE,INPTBD,BEAUFT,
                          BINFIL,MIEINP,DEFALT,EXOATM,STGEOM,CIRRUS,
                          ZROHDR,UPCASE,LWCASE,IOERR,GBLBCK,GETASP,
                          DFLT2,FILOPN,FILRT,ATMSBD,BKGDBD,GETEXO,
                          EXOTMP
```

Local Variable Declarations:

```
      INTEGER           I,K,L,M,ITYPE,NVAR,IDAYX,NXTRAP,IOS,ISUB,
                          ISWINP(17),IXOTMP,KK,LL,NTX,IZERO,ITYP0,
                          ISCENE,JSHINE,NXTRP,IT,M1,M2
CEXO  INTEGER           KP,ISNSPT
      REAL              HCLDBS,DELCLD,DYEAR,TINF0,TDUM(2),TMIDN,TNOON,
                          FRSNWP,FRICEP,TAIRP,CLDCVP(0:3),HBK,WIND0,TAIR0,
                          ABSLAT,FACLAT,FRWTRP
CEXO  REAL              F,FBAR
CEXO  LOGICAL           FLEXO
      CHARACTER*1       DOT
      CHARACTER*20      VRDATA(14)
      CHARACTER*50      VARSUB
      CHARACTER*80      DUMMY,FILENM(17)
      CHARACTER*255     VARIAB

COMMON Blocks:          /ANTECD/,/ATMDAT/,/BACKGD/,/CONSTN/,/DEVICE/,/FLAGS/,
                          /HEADER/,/INITAL/,/INPTDT/,/OUTPUT/,/VSADTA/
```

SUBROUTINE INTEG

Argument Declarations:

V - REAL Variable (Input) - Wavenumber (cm^{-1})
FLTR - REAL Variable (Input) - Filter weighting factor
BW - REAL Variable (Input/Output) - Band width (cm^{-1})
BWL - REAL Variable (Input/Output) - Band width (μm)
NAZ - INTEGER Variable (Input) - Number of observer/source azimuths
NASPCT - INTEGER Variable (Input) - Number of earth/skyshine elevation angles
NAZSH - INTEGER Variable (Input) - Number of earth/skyshine azimuth angles
NSRCE - INTEGER Variable (Input) - Location of source in ray
NBKGD - INTEGER Variable (Input) - Location of background in ray
BKSUMV - REAL Array (Dim = 6 x NMATL x Unspecified) (Input/Output) - Spectral background radiance for each material ($W/cm^2/sr/cm^{-1}$)
SIGMEP - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - Scintillation along path
TAUSCP - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - In-scattered transmittance along path
RADSLP - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - Solar irradiance along path ($W/cm^2/cm^{-1}$)
RADLNP - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - Lunar irradiance along path ($W/cm^2/cm^{-1}$)
RADPTH - REAL Array (Dim = NAZMAX x MLMX2 x Unspecified) (Input/Output) - Emitted path radiance along path ($W/cm^2/sr/cm^{-1}$)
DRADP - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - Emitted path radiance along path ($W/cm^2/sr/cm^{-1}$)
RDSLSP - REAL Array (Dim = NAZMAX x MLMX2 x Unspecified) (Input/Output) - Scattered radiance along path ($W/cm^2/sr/cm^{-1}$)
TAULR - REAL Array (Dim = NAZMAX x Unspecified) (Input/Output) - Transmittance along path
IGEOM - INTEGER Variable (Input) - Geometry index

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,MLMAX,MLMX2,NZSMAX,NMATL,
                         MAXLAT,MAXLON,NGMAX
      PARAMETER         (NAZMAX=30, NASMAX=15, NZSMAX=4, NGMAX=15)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (NMATL=28, MAXLAT=3, MAXLON=1)
```

Local Variable Declarations:

```
      INTEGER           K,M,MM,LB
      REAL              DBW
```

COMMON Blocks: /BCKDAT/,/INTSTO/

SUBROUTINE INTR2D

Argument Declarations:

```
  X0     - REAL Variable (Input) - X-component of point to be evaluated
  Y0     - REAL Variable (Input) - Y-component of point to be evaluated
  X      - REAL Vector (Len = Unspecified) (Input) - X-component of grid
  NX     - INTEGER Variable (Input) - Number of X grid points
  NXMAX  - INTEGER Variable (Input) - Maximum number of X grid points
  Y      - REAL Vector (Len = Unspecified) (Input) - Y-component of grid
  NY     - INTEGER Variable (Input) - Number of Y grid points
  FAC    - REAL Array (Dim = NXMAX x Unspecified) (Output) - Interpolation
           weights
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX,MIN,ABS
```

Local Variable Declarations:

```
      INTEGER          I,J,IX,IXP,IY,IYP
      REAL             FX,FY
```

COMMON Blocks: None

CHARACTER*72 FUNCTION IOERR

Argument Declarations:

```
  IOS    - INTEGER Variable - Value returned by IOSTAT
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     GERROR
CLAH  EXTERNAL         IOSTAT_MSG
      EXTERNAL         GERROR
```

Local Variable Declarations:

```
CVAX  CHARACTER*48     CHERRV(68)
CLAH  CHARACTER*152    MESSAG
CIBM  INTEGER*2        I2(2)
CIBM  INTEGER          I
```

COMMON Blocks: None

SUBROUTINE ISRAEL

Argument Declarations:

```
  ISMX   - INTEGER Variable (Input) - First DIMENSION of MC
  MA     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Model atmosphere index
  MP     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Pressure profile index
  MT     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Temperature profile index
  MC     - INTEGER Array (Dim = ISMX x MAXLAT x Unspecified)
             (Input/Output) - Molecular concentrations profile index
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER          NGMAX,MAXLAT
      PARAMETER        (NGMAX=15, MAXLAT=3)
```

Local Variable Declarations:

```
      INTEGER          K,KK,LL
```

COMMON Blocks: /FLAGS/

INTEGER FUNCTION ISTAER

Argument Declarations:

```
  IAERO1 - INTEGER Variable - Boundary layer aerosol type
  IAERO2 - INTEGER Variable - Stratospheric aerosol type
  ITRPAU - INTEGER Variable - Tropopause index
             ITRPAU = 0 implies that Z is below the tropopause
             ITRPAU = 1 implies that Z is above the tropopause
  ISTPAU - INTEGER Variable - Stratopause index
             ISTPAU = 0 implies that Z is below the stratopause
             ISTPAU = 1 implies that Z is above the stratopause
  Z      - REAL Variable - Altitude (km)
  HB     - REAL Variable - Terrain altitude (km)
  IHAZE  - INTEGER Variable - Haze profile index
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,NASMAX,ISMX,MOLMAX
      PARAMETER        (MLMAX=140, NASMAX=15)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             HLOWT
      EXTERNAL         HLOWT
```

Local Variable Declarations:

```
      INTEGER          L,ILYR
```

COMMON Blocks: /USERDF/

SUBROUTINE KDISTR

Argument Declarations: None

PARAMETER Declarations:

```
      INTEGER          NAZMAX,MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,NASMAX,
                         NZSMAX,NVSMAX,MOLMAX,MLIDMX
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MAXLAT=3, MAXLON=1, NVSMAX=20, MLIDMX=45)
```

Local Variable Declarations:

```
      INTEGER          J,L,KK,LL
      REAL             SCATM,EXTNCM
```

COMMON Blocks: /BCKDAT/,/HEADER/,/KDISDT/,/MOLECP/,/PRBNDA/, /PRBNDB/

SUBROUTINE LAYLW

Argument Declarations:

X - REAL Array (Dim = 10 x Unspecified) (Input/Output) - Optical path or path-weighted temperature matrix

Local Variable Declarations:

```
      INTEGER          I,J
```

COMMON Blocks: None

SUBROUTINE LCTRIM

Argument Declarations:

CHRSTR - CHARACTER*(*) Variable (Input/Output) - CHARACTER String

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        LEN
```

Local Variable Declarations:

```
      INTEGER          I,K,ISTART,IMAXLN
```

COMMON Blocks: None

INTEGER FUNCTION LENSTR

Argument Declarations:

CHRSTR - CHARACTER*(*) Variable - Input CHARACTER string

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        LEN
```

Local Variable Declarations:

```
      INTEGER          I,IMXLEN
```

COMMON Blocks: None

CHARACTER*(*) FUNCTION LWCASE

Argument Declarations:

STRING - CHARACTER*(*) Variable - Input string

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        LEN,INDEX
```

Local Variable Declarations:

```
      INTEGER          I,LOC
      CHARACTER*26     UPPER,LOWER
```

COMMON Blocks: None

SUBROUTINE LYRINT

Argument Declarations:

TSRF - REAL Variable (Input) - Initial surface temperature (K)
TLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) - Temperatures in conducting subsurface (K)
TSSL - REAL Variable (Input) - Initial sub-surface temperature (K)
ZLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) - Layer depth (m)
NLAYER - INTEGER Variable (Input) - Number of layers
SPHEAT - REAL Vector (Len = Unspecified) (Input) - Specific heat (W-sec/gm/K)
DENSTY - REAL Vector (Len = Unspecified) (Input) - Density (gm/m^3)
HTCOND - REAL Vector (Len = Unspecified) (Input) - Conductance coefficient ($W/m^2/K$)
ZHLYR - REAL Vector (Len = Unspecified) (Input) - Material layer

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        SQRT,EXP,REAL,COS
```

Local Variable Declarations:

```
      INTEGER          L,LS
      REAL             DAMPD,PERIOD,DZ
```

COMMON Blocks: /CONSTN/

SUBROUTINE MARINE

Argument Declarations:

VIS - REAL Variable (Output) - Meteorological range (km)
WIND - REAL Variable (Input) - Current wind speed (m/sec)
WHH - REAL Variable (Input) - 24-hour average wind speed (m/sec)
ICSTL - INTEGER Variable (Input) - Air mass character index
ICSTL = 1 implies open ocean
ICSTL = 10 implies strong continental influence
Values in between represent varying degrees of continental influence.
BEXT - REAL Vector (Len = Unspecified) (Output) - Extinction coefficient (km^{-1})
BABS - REAL Vector (Len = Unspecified) (Output) - Absorption coefficient (km^{-1})
RH - REAL Variable (Input) - Relative humidity

PARAMETER Declarations:

```
      INTEGER           NWLAER,NWLCLD,NANG
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,MAX,MIN
      EXTERNAL          MARNBD,PROFAC,ARSABD,ARSLBD,ARSXBD
```

Local Variable Declarations:

```
      INTEGER           I,J,K,JRH,JRHP
      REAL              A(3),PISC,WS,WH,FAC,TOTAL,QE,EXT55,C,TXV,TAV,F,
                          RHX
```

COMMON Blocks: /AEROSL/,/AERSLA/,/AERSLX/,/CONSTN/,/NAVMAR/

INTEGER FUNCTION MDLATM

Argument Declarations:

ITYPE - INTEGER Variable - Latitude index
ISEASN - INTEGER Variable - Season index

Local Variable Declarations:

```
      INTEGER           LATIT,KSEASN
```

COMMON Blocks: None

SUBROUTINE MIE

Argument Declarations:

```
  RADIUS - REAL Variable (Input) - Particle radius (μm)
  WL     - REAL Variable (Input) - Wavelength (μm)
  XNP    - COMPLEX Variable (Input) - Complex index of refraction
  RNB    - COMPLEX Variable (Input) - Complex index of refraction of the
             medium
  NSANGL - INTEGER Variable (Input) - Number of scattering angles
  QABSP  - REAL Variable (Output) - Absorption coefficient (km-1 per
             (particles cm-3))
  QSCAT  - REAL Variable (Output) - Absorption coefficient (km-1 per
             (particles cm-3))
  GQSCAT - REAL Variable (Output) - Asymmetry coefficient times QSCAT
```

PARAMETER Declarations:

```
C**** For extremely large particles, NMAX may have to be increased.
       If Error No. 86 is encountered, then increase NMAX accordingly.

      INTEGER          NXMIE,NMAX
      PARAMETER        (NXMIE=101, NMAX=20000)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          NCYCLE
      INTRINSIC        CMPLX,INT,REAL,DBLE,ABS,MAX,CONJG,COS,SIN
      EXTERNAL         NCYCLE
```

Local Variable Declarations:

```
      INTEGER          J,N,NMX,NSTOP,N1,N2,M1,M2,M3,NS2,JJ
      REAL             CHI(3),FN,TAUI,P,T,X,DUM,QEXT
      DOUBLE PRECISION PSI(3)
      COMPLEX          D(NMAX),Y,XI(3),AN(2),BN(2),REFREL
```

COMMON Blocks: /CONSTN/,/MIECOT/

SUBROUTINE MIEINP

Argument Declarations:

IMATRL - INTEGER Variable (Input) - Material index

PARAMETER Declarations:

```
      INTEGER           NWLMX,MOLMAX
      PARAMETER         (NWLMX=100, MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT
      REAL              GETVAR
      CHARACTER*1       UPCASE
      CHARACTER*3       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         CMPLX
      EXTERNAL          GETVAR,IGTINT,GETVEC,RDLINE,PARSE,UPCASE,
                          LWCASE,IOERR,DEVCBD
```

Local Variable Declarations:

```
      INTEGER           I,J,N,IOS,NVAR,ICOL0,ICOL40,NVAR8,NVAR1,NVAR2,
                          NVAR3,NVAR50
      REAL              DUM(4),XNR(3),XNI(3)
      CHARACTER*1       DOT,MTYPE(3)
      CHARACTER*20      VRDATA(8)
      CHARACTER*80      TITLE,DUMMY
      CHARACTER*255     VARIAB
```

COMMON Blocks: /DEVICE/,/MATERL/

SUBROUTINE MIEPHS

Argument Declarations:

WL	- REAL Variable (Input) - Wavelength (μm)
QABSP	- REAL Variable (Output) - Absorption coefficient (km^{-1} per (particles cm^{-3}))
QSCAT	- REAL Variable (Output) - Absorption coefficient (km^{-1} per (particles cm^{-3}))
G	- REAL Variable (Output) - Asymmetry coefficient
THETA	- REAL Vector (Len = Unspecified) (Input) - Scattering angles (deg)
PHASE	- REAL Array (Dim = 4 x Unspecified) (Output) - Phase function
NANG	- INTEGER Variable (Input) - Number of scattering angles
TEMP	- REAL Variable (Input) - Temperature (K)
IMATRL	- INTEGER Variable (Input) - Particle index

PARAMETER Declarations:

```
      INTEGER           NXMIE
      PARAMETER         (NXMIE=101)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              DNDR
      COMPLEX           INDEXI,INDEXW,EMTREF
      INTRINSIC         CMPLX,REAL,COS,LOG10,MAX,MIN,ABS,DPROD,AIMAG
      EXTERNAL          DNDR,COAT,PROFAC,INDEXI,INDEXW,EMTREF,MIE
```

Local Variable Declarations:

```
      INTEGER           I,J,K,KEY,KEYP,ISWTCH(5),NINCL1
      REAL              RADCOR,QABSI,QSCATI,GI,AREA,SUM,CHKA,DELR,RADN,
                          RADNP,WT,DRL,FAC,PCTP(5),X
      COMPLEX           RNB,XNJ(3),XNP(2)
```

COMMON Blocks: /CONSTN/,/MATERL/,/MIECOT/

SUBROUTINE MLSCAT

Argument Declarations:

```
  L      - INTEGER Variable (Input) - Altitude index
  RTH    - REAL Variable (Output) - Scattered thermal radiance (W/sr/cm^2/cm^-1)
  RSL    - REAL Variable (Output) - Scattered solar radiance (W/sr/cm^2/cm^-1)
  TAU    - DOUBLE PRECISION Variable (Input) - Transmittance
  DRKM   - REAL Variable (Input) - Incremental path lengths along raypath (km)
  PHI    - REAL Variable (Input) - Elevation angle (deg)
  IZL    - INTEGER Variable (Input) - Altitude layer index
  PTHFAC - REAL Array (Dim = MAXLAT x Unspecified) - Proportionality
             factor for multiple atmospheres
  NPTH   - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits for
             non-zero elements of PTHFAC
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NBAND,NANG,MAXLAT,MAXLON
      PARAMETER         (MLMAX=140, NBAND=16, NANG=65)
      PARAMETER         (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RADTRY,BETAU
      INTRINSIC         ABS,SIN,DPROD,DBLE
      EXTERNAL          BETAU,RADTRY
```

Local Variable Declarations:

```
      INTEGER           KK,LL
      REAL              XMU,BU,FU,SCTOT,ASYMT,HMT(2),HPT(2)
      DOUBLE PRECISION  DELTAU,SCT1,SCT2,SCT3,SCT4,DDRKM,DUM,TAUP
```

COMMON Blocks: /ARSLSC/,/CONSTN/,/LYRSTO/

SUBROUTINE MODBCK

Argument Declarations:

```
  FRACT  - REAL Vector (Len = Unspecified) (Input/Output) - Fraction of
             scene materials
  INDEXB - INTEGER Vector (Len = Unspecified) (Input/Output) - Index of
             scene materials
  KMATL  - INTEGER Variable (Input/Output) - Number of materials in scene
  SNOW   - REAL Variable (Input) - Percent of scene that is snow (%)
  ICE    - REAL Variable (Input) - Percent of scene that is ice (%)
  WATER  - REAL Variable (Input) - Percent of scene that is water (%)
  TEMP   - REAL Variable (Input) - Air temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MAX,MIN
```

Local Variable Declarations:

```
      INTEGER           K,IS,IX(12)
      REAL              SNW,FX(12),FRDUM,XICE,XWTR
```

COMMON Blocks: None

INTEGER FUNCTION MONTH

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Month identifier

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*3       UPCASE
      EXTERNAL          LCTRIM,UPCASE
```

Local Variable Declarations:

```
      INTEGER           I,J
      CHARACTER*3       CHMNTH(12,2),CHVARP
```

COMMON Blocks: None

PROGRAM MOSART

PARAMETER Declarations:

```
      INTEGER           NGMAX,NXMAX,NAZMAX,NASMAX,MAXLAT,MAXLON,NVSMAX,
                          ISMX,MLMAX,NZSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NXMAX=100)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SLPOS
      CHARACTER*72      IOERR
      EXTERNAL          CNSTNT,DEVCBD,TITLCR,EQUABS,INITL,CALCUL,SLPOS,
                          RDFLTR,DBINIT,EPHEMS,CONFIG,PROMPT,IOERR
```

Local Variable Declarations:

```
      INTEGER           LENP(NGMAX),ISMARY,ISHINE(NGMAX),NXTRA,IFLTR,
                          IOS,ISLPOS
      REAL              HXTRA(NXMAX)
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG,FILERT
      CHARACTER*80      TITLE
```

COMMON Blocks: /DEVICE/,/FLAGS/ ,/HEADER/,/INITAL/

SUBROUTINE MRNDFL

Argument Declarations:

ICSTL - INTEGER Variable (Input/Output) - Air mass character index
ICSTL = 1 implies open ocean
ICSTL = 10 implies strong continental influence
Values in between represent varying degrees of continental influence

ELPST - REAL Variable (Input) - Elapsed time since air parcel left land (days)

RADON - REAL Variable (Input) - Current radon 222 concentration (pCi/m^3)

INTRINSIC and EXTERNAL Declarations:

```
INTRINSIC        INT,EXP
```

INTEGER FUNCTION NCHAER

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Aerosol model identifier

INTRINSIC and EXTERNAL Declarations:

```
CHARACTER*5      UPCASE
EXTERNAL         LCTRIM,UPCASE
```

Local Variable Declarations:

```
INTEGER          I,J
CHARACTER*5      CHAER(0:20,2),CHVARP
```

COMMON Blocks: None

INTEGER FUNCTION NCHATM

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Model atmosphere identifier

INTRINSIC and EXTERNAL Declarations:

```
CHARACTER*6      UPCASE
EXTERNAL         LCTRIM,UPCASE
```

Local Variable Declarations:

```
INTEGER          I,J
CHARACTER*6      CHATM(0:11,2),CHVARP
```

COMMON Blocks: None

INTEGER FUNCTION NCHAZE

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Season identifier

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*6       UPCASE
      EXTERNAL          LCTRIM,UPCASE
```

Local Variable Declarations:

```
      INTEGER           I,J
      CHARACTER*6       CHAZE(-1:10,2),CHVARP
```

COMMON Blocks: None

INTEGER FUNCTION NCHSEA

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Season identifier

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*6       UPCASE
      EXTERNAL          LCTRIM,UPCASE
```

Local Variable Declarations:

```
      INTEGER           I,J
      CHARACTER*6       CHSEA(0:11,2),CHVARP
```

COMMON Blocks: None

INTEGER FUNCTION NCYCLE

Argument Declarations:

```
N      - INTEGER Variable - Argument
NMOD   - INTEGER Variable - Modulus
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MOD
```

Local Variable Declarations:

```
      INTEGER           M
```

COMMON Blocks: None

SUBROUTINE NXXPAU

Argument Declarations:

```
  ZL     - REAL Vector (Len = Unspecified) (Input) - Altitudes (km)
  PL     - REAL Vector (Len = Unspecified) (Input) - Pressure profile (mb)
  TL     - REAL Vector (Len = Unspecified) (Input) - Temperature
             profile (K)     nxx
  ML     - INTEGER Variable (Input) - Number of altitude/temperature/
             pressure values
  NTRPAU - INTEGER Variable (Output) - Location of tropopause
  NSTPAU - INTEGER Variable (Output) - Location of stratopause
  NMSPAU - INTEGER Variable (Output) - Location of mesopause
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IBNSRC
      REAL              XTERP
      INTRINSIC         MIN
      EXTERNAL          XTERP,IBNSRC,PROFAC
```

Local Variable Declarations:

```
      INTEGER           L,MLM,LP,LPP,LX,LCHECK,KEY,ITRP0
      REAL              DZ,DT,DTDZ,Z1,Z2,T1,T2,DTDZAV,DZX,DTDZX,TMAX,
                          FAC
```

COMMON Blocks: None

REAL FUNCTION O2CNT

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  TEMP   - REAL Variable - Temperature (K)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         INT,REAL,MIN,EXP
      EXTERNAL          O2CBD
```

Local Variable Declarations:

```
      INTEGER           I,IP
      REAL              TD,FAC,VX,O2C1,O2C2
```

```
COMMON Blocks:          /O2C/
```

SUBROUTINE OPATH

Argument Declarations:

```
  T      - REAL Vector (Len = Unspecified) (Input) - Temperature (K)
  P      - REAL Vector (Len = Unspecified) (Input) - Pressure (mb)
  ZP     - REAL Vector (Len = Unspecified) (Input) - Altitude (m)
  UP     - REAL Vector (Len = Unspecified) (Input) - H2O density (PS*TS*ppmv)
  VP     - REAL Vector (Len = Unspecified) (Input) - CO2 density (PS*TS*ppmv)
  WP     - REAL Vector (Len = Unspecified) (Input) - O3 density (PS*TS*ppmv)
  ARSLAS - REAL Vector (Len = Unspecified) (Input) - Aerosol absorption in
             the solar region (km-1)
  ARSLSS - REAL Vector (Len = Unspecified) (Input) - Aerosol scattering in
             the solar region (km-1)
  ARSLAT - REAL Vector (Len = Unspecified) (Input) - Aerosol absorption in
             the thermal region (km-1)
  ARSLST - REAL Vector (Len = Unspecified) (Input) - Aerosol scattering in
             the thermal region (km-1)
  CLDP   - REAL Vector (Len = Unspecified) (Input) - Cloud cover (%)
             1 - Low etage
             2 - Middle etage
             3 - High etage
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SATUR
      INTRINSIC         MAX,MIN
      EXTERNAL          SATUR,LAYLW,TRANLW
```

Local Variable Declarations:

```
      INTEGER           I,J,K,JM,JP,ITYPE
      REAL              CU,CV,CW,CX(2),CY,CZ(2),CTU,CTV,CTW,CTX,DQ1,
                          DQ2,DQ3,DZ,UNORM,VNORM,WNORM,XNORM,YNORM,
                          ZNORM,P0,T0,DENS
```

COMMON Blocks: /CLIMAT/,/OMATLW/

SUBROUTINE OPNSCR

Argument Declarations:

```
  IFSCR  - INTEGER Variable (Input/Output) - Scratch file device
             number
  LABEL  - CHARACTER*(*) Variable (Input) - File label
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           I,IOS
```

COMMON Blocks: None

SUBROUTINE PARSE

Argument Declarations:

```
  VARIN  - CHARACTER*(*) Variable (Input) - Input string
  VAROUT - CHARACTER*(*) Vector (Output) (Len = Unspecified) - Vector
             output string
  N      - INTEGER Variable (Output) - Length of vector string
  NMAX   - INTEGER Variable (Input) - Maximum length of vector string
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           LENSTR
      INTRINSIC         LEN,MIN
      EXTERNAL          LCTRIM,LENSTR
```

Local Variable Declarations:

```
      INTEGER         I,IM,IP,LINMAX,LOUTMX,ISW
```

COMMON Blocks: None

REAL FUNCTION PARTIT

Argument Declarations:

```
  TEMP   - REAL Variable - Temperature (K)
  MOLEC  - INTEGER Variable - Molecular index
             MOLEC =  1 implies Water vapor (H2O)
             MOLEC =  2 implies Carbon dioxide (CO2)
             MOLEC =  3 implies Ozone (O3)
             MOLEC =  4 implies Nitrous oxide (N2O)
             MOLEC =  5 implies Carbon monoxide (CO)
             MOLEC =  6 implies Methane (CH4)
             MOLEC =  7 implies Oxygen (O2)
             MOLEC =  8 implies Nitric oxide (NO)
             MOLEC =  9 implies Sulfur dioxide (SO2)
             MOLEC = 10 implies Nitrogen dioxide (NO2)
             MOLEC = 11 implies Ammonia (NH3)
             MOLEC = 12 implies Nitric acid (HNO3)
             MOLEC = 13 implies Hydroxyl radical (OH)
             MOLEC = 14 implies Hydrogen fluoride (HF)
             MOLEC = 15 implies Hydrogen chloride (HCl)
             MOLEC = 16 implies Hydrogen bromide (HBr)
             MOLEC = 17 implies Hydrogen iodide (HI)
             MOLEC = 18 implies Chlorine monoxide (ClO)
             MOLEC = 19 implies Carbonyl sulfide (OCS)
             MOLEC = 20 implies Formaldehyde (H2CO)
             MOLEC = 21 implies Hypochlorous acid (HOCl)
             MOLEC = 22 implies Nitrogen (N2)
             MOLEC = 23 implies Hydrogen cyanide (HCN)
             MOLEC = 24 implies Methyl chloride (CH3Cl)
             MOLEC = 25 implies Hydrogen peroxide (H2O2)
             MOLEC = 26 implies Acetylene (C2H2)
             MOLEC = 27 implies Ethane (C2H6)
             MOLEC = 28 implies Phosphine (PH3)
             MOLEC = 29-32 are for future growth
             MOLEC = 33 implies CFC-11 (CCl3F)
             MOLEC = 34 implies CFC-12 (CCl2F2)
             MOLEC = 35 implies CFC-13 (CClF3)
             MOLEC = 36 implies CFC-14 (CF4)
             MOLEC = 37 implies CFC-22 (CHF2Cl)
             MOLEC = 38 implies CFC-113 (C2CL3F3)
             MOLEC = 39 implies CFC-114 (C2Cl2F4)
             MOLEC = 40 implies CFC-115 (C2ClF5)
             MOLEC = 41 implies ClONO2
             MOLEC = 42 implies HNO4
             MOLEC = 43 implies CHCl2F
             MOLEC = 44 implies CCl4
             MOLEC = 45 implies N2O5
```

PARAMETER Declarations:

```
      INTEGER           MLIDMX
      PARAMETER         (MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         EXP,DPROD,REAL,DBLE
      EXTERNAL          MOLPBD
```

Local Variable Declarations:

```
      INTEGER           I
      REAL              TREF
      DOUBLE PRECISION QROT,QVIB,QV,QV0
```

COMMON Blocks: /MOLDAT/

REAL FUNCTION PFR

Argument Declarations:

T - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         SQRT,EXP
```

Local Variable Declarations:

```
      INTEGER           J
      REAL              VIB(3),QJ,T1,T2,T1S,T2S,V,T11,T22
```

COMMON Blocks: None

SUBROUTINE PHFUNC

Argument Declarations:

```
V       - REAL Variable (Input) - Wavenumber (cm-1)
IAERO   - INTEGER Variable (Input) - Index for aerosol type
ICLOUD  - INTEGER Variable (Input) - Index for water cloud type
ICLDRN  - INTEGER Variable (Input) - Index for cloud and rain
IICE    - INTEGER Variable (Input) - Index for ice cloud type
ICIRUS  - INTEGER Variable (Input) - Index for cirrus cloud type
RNRATE  - REAL Variable (Input) - Rain rate (mm/hr)
SNRATE  - REAL Variable (Input) - Snowfall rate (mm/hr in equiv. water)
L       - INTEGER Variable (Input) - Altitude index
SCTM    - REAL Variable (Input) - Molecular single-scattering coefficient
            (km-1)
SCTA    - REAL Variable (Input) - Aerosol single-scattering coefficient
            (km-1)
SCTC    - REAL Variable (Input) - Water cloud single-scattering coefficient
            (km-1)
SCTI    - REAL Variable (Input) - Ice cloud single-scattering coefficient
            (km-1)
SCTR    - REAL Variable (Input) - Rain single-scattering coefficient (km-1)
SCTS    - REAL Variable (Input) - Snow single-scattering coefficient (km-1)
SCTCI   - REAL Variable (Input) - Cirrus cloud single-scattering
            coefficient (km-1)
TEMP    - REAL Variable (Input) - Temperature (K)
KK      - INTEGER Variable (Input) - Latitude index
LL      - INTEGER Variable (Input) - Longitude index
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NWLAER,NWLCLD,NANG,MAXLAT,MAXLON,NSTTMP
      PARAMETER         (MLMAX=140, NSTTMP=16)
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
      PARAMETER         (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              CSPHFN
      INTRINSIC         MIN,ABS
      EXTERNAL          PROFAC,PHFGBD,PHSTBD,PHTRBD,ARSLBD,PHMABD,
                          CSPHFN,PHYDRO,PHURBD,PHRUBD,PHOCBD,BKSTBD
```

Local Variable Declarations:

```
      INTEGER           JWL(8),JWLP(8),I,JTMP,JTMPP
      REAL              FACWL(8),WLX,ASYWC,ASYIC,ASYMR,ASYMS,P1,P2,
                          ASYMM,SCTSUM,FACTMP,ASYDUM,ASYCI,WLY
```

```
COMMON Blocks:          /AEROSL/,/AERSCA/,/AERUSR/,/ARSLSC/,/BSTAER/,
                          /CONSTN/,/PHFFOG/,/PHFMAR/,/PHFOCE/,/PHFRUR/,
                          /PHFSTR/,/PHFTRP/,/PHFURB/
```

REAL FUNCTION PHMLSC

Argument Declarations:

V - REAL Variable - Wavenumber (cm^{-1})
PHI - REAL Variable - Scattering angle (deg)

INTRINSIC and EXTERNAL Declarations:

REAL	DEPOL
INTRINSIC	COS
EXTERNAL	DEPOL

Local Variable Declarations:

REAL	WL,DPL

COMMON Blocks: /CONSTN/

SUBROUTINE PHYDRO

Argument Declarations:

V - REAL Variable (Input) - Wavenumber (cm^{-1})
ICLOUD - INTEGER Variable (Input) - Index for water cloud type
ICLDRN - INTEGER Variable (Input) - Index for cloud and rain
SCTC - REAL Variable (Input) - Scattering coefficient for clouds (km^{-1})
IICE - INTEGER Variable (Input) - Index for ice cloud type
SCTI - REAL Variable (Input) - Scattering coefficient for ice clouds (km^{-1})
ICIRUS - INTEGER Variable (Input) - Index for cirrus cloud type
SCTCI - REAL Variable (Input) - Scattering coefficient for cirrus (km^{-1})
RNRATE - REAL Variable (Input) - Rain rate (mm/hr)
SCTR - REAL Variable (Input) - Scattering coefficient for rain (km^{-1})
SNRATE - REAL Variable (Input) - Snowfall rate (mm/hr in equiv. water)
SCTS - REAL Variable (Input) - Scattering coefficient for snow (km^{-1})
ASYWC - REAL Variable (Output) - Water cloud asymmetry factor
ASYIC - REAL Variable (Output) - Ice cloud asymmetry factor
ASYMR - REAL Variable (Output) - Rain asymmetry factor
ASYMS - REAL Variable (Output) - Snow asymmetry factor
ASYCI - REAL Variable (Output) - Cirrus cloud asymmetry factor
TEMP - REAL Variable (Input) - Temperature (K)

PARAMETER Declarations:

INTEGER	NWLAER,NWLCLD,NANG
PARAMETER	(NWLAER=47, NWLCLD=79, NANG=65)

INTRINSIC and EXTERNAL Declarations:

REAL	CSPHFN,XTERP
INTRINSIC	MIN,ABS
EXTERNAL	PROFAC,PHHYBD,CSPHFN,CIRRBD,XTERP,ARSLBD

Local Variable Declarations:

INTEGER	KWL,KWLP,KRT,KRTP,I,KTP,KTPP,JCIR,ITRP0
REAL	FACWL,WLX,WLY,FACRT,FACTP,ASYM1,ASYM2

COMMON Blocks: /AEROSL/,/CLDUSR/,/CONSTN/,/CRASYM/,/PHHYDR/

REAL FUNCTION PLANCK

Argument Declarations:

```
  TEMP   - REAL Variable - Temperature (K)
  V      - REAL Variable - Wavenumber (cm-1)
  DV     - REAL Variable - Wavenumber increment (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,DBLE,EXP,DPROD,LOG
```

Local Variable Declarations:

```
      INTEGER          I
      REAL             VP
      DOUBLE PRECISION X,Y,C1,C2,XMU(3),WT(3),DPLNCK
```

COMMON Blocks: /CONSTN/

SUBROUTINE PLANET

Argument Declarations:

```
  CENT   - DOUBLE PRECISION Variable (Input) - Universal time in centuries
             from 1900.0
  LABSUN - DOUBLE PRECISION Variable (Input) - Mean longitude
  ANOMN  - DOUBLE PRECISION Variable (Input) - Mean anomaly
  PERTUB - DOUBLE PRECISION Variable (Output) - Planetary nutation and
             longitude perturbations
  PERVEN - DOUBLE PRECISION Variable (Output) - Latitude perturbations of sun
             by Venus
  PERJUP - DOUBLE PRECISION Variable (Output) - Latitude perturbations of sun
             by Jupiter
  XMNLAT - DOUBLE PRECISION Variable (Output) - Moon mean argument of latitude
  OBLNUT - DOUBLE PRECISION Variable (Output) - Nutation in obliquity
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MOD,SIN,COS
```

Local Variable Declarations:

```
      DOUBLE PRECISION DDCIR,ANOMLN,ELONLN,ANOMVN,PERT,ANOMAR,ANOMJP,
                       ANOMSA,XNUTLN,PERINE,ASCNOD,XLONLN
```

COMMON Blocks: /CONSTN/

SUBROUTINE PLMSUB

Argument Declarations:

```
  XN      - REAL Array (Dim = NGAS x Unspecified) (Output) - Optical depth
  ACNP    - REAL Array (Dim = NGAS x Unspecified) (Output) - Summing variable
              for Lorentz line width
  ACND    - REAL Array (Dim = NGAS x Unspecified) (Output) - Summing variable
              for Doppler Line width
  COMA    - REAL Array (Dim = NGAS x Unspecified) (Output) - Optical depth
              for each atmospheric gas specie and each line group
  TAUL    - REAL Vector (Len = Unspecified) (Output) - Optical depth for
              each atmospheric gas specie
  COMAE   - REAL Variable (Output) - Optical depth for aerosols
  SLTSC   - REAL Variable (Output) - Optical depth due to aerosol and
              molecular scattering
  CNTCO2  - REAL Variable (Output) - Optical depth due to CO2 continuum
  CNTH2O  - REAL Variable (Output) - Optical depth due to H2O continuum
  MM      - INTEGER Variable (Input) - Azimuth index
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,MLMX2,NAZMAX,NGAS,NNNMAX,ISMX,MAXLAT,
                         MAXLON,NGMAX,MOLMAX,MLIDMX
      PARAMETER        (MLMAX=140, MLMX2=2*MLMAX, MLIDMX=45)
      PARAMETER        (NGAS=6, NNNMAX=5, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (NGMAX=15, NAZMAX=30)
      PARAMETER        (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             COMFNC
      EXTERNAL         COMFNC,MOLPBD
```

Local Variable Declarations:

```
      INTEGER          I,K,L,KL,IV,MLC,KK,LL
      REAL             P0,PS,DUMA,DUMB,DUMF,DUMG,DUMX,SDX,CDX,CDY,ADX,
                         ALX,CD1,CD2
```

```
COMMON Blocks:         /INITAL/,/MOLCON/,/MOLECP/,/PATH1/ ,/PATH1A/,
                         /PLMDAT/,/PRBNDA/,/PRBNDB/
```

DOUBLE PRECISION FUNCTION POLY

Argument Declarations:

```
  X       - DOUBLE PRECISION Variable - Argument
  C       - DOUBLE PRECISION Vector (Len = Unspecified) - Coefficients
  N       - INTEGER Variable - Length of C
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: None

SUBROUTINE PRALT

Argument Declarations:

```
  PRESS  - REAL Variable (Input) - Atmospheric pressure (mb)
  ALT    - REAL Variable (Output) - Pressure altitude (km)
  IERR   - INTEGER Variable (Output) - Error flag
             IERR = 0 implies no error
             IERR = 1 implies PRESS is greater than 1777.6 mb
             IERR = 2 implies PRESS is less than 0.0044568 mb
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          IBNSRC
      INTRINSIC        MIN,LOG
      EXTERNAL         IBNSRC
```

Local Variable Declarations:

```
      INTEGER          KEY,KEYP
      REAL             Z(58),P(58),FAC
```

COMMON Blocks: None

SUBROUTINE PRCALC

Argument Declarations:

```
  IFSCRI - INTEGER Variable (Input) - File number for source skyshine
             solar path data
  INITV  - INTEGER Variable (Input) - Initial value for spectral loop.  For
             standard calculations, INITV = 1.  For restart calculations, it
             provides the value at which to restart.
  INITGM - INTEGER Variable (Input) - Initial value for geometry loop.  For
             standard calculations, INITGM = 1.  For restart calculations,
             it provides the value at which to restart.
  IV     - INTEGER Variable (Input) - Spectral interval number
  HEADNG - CHARACTER*(*) Variable (Input) - File heading
  TITLE  - CHARACTER*(*) Variable (Input) - File title
  IFLTR  - INTEGER Variable (Input) - Filter index
  TFLTR  - CHARACTER*(*) Variable (Input) - Filter title
  ISMARY - INTEGER Variable (Input) - Summary index
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input) - Switch
             for model atmospheres
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGAS,NNNMAX,MLMAX,ISMX,MLMX2,
                          ISTMAX,NBAND,NGMAX,NZSMAX,NMATL,NWLAER,
                          NWLCLD,NANG,MAXLAT,MAXLON,NL,NVSMAX,MOLMAX,
                          MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (ISTMAX=30000)
      PARAMETER         (NBAND=16, NNNMAX=5, NGAS=6, NMATL=28)
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (NL=50)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SOLAR,SLUNAR,SCINTL,PLANCK,DPLDT,FILTER
      CHARACTER*72      IOERR
      INTRINSIC         MAX,MIN,REAL,SQRT,LOG
      EXTERNAL          BNDPAR,SOLAR,BNTPTH,PLANCK,BCKGND,SOLRAD,
                          PTHTAU,RESOLV,SCINTL,DEVCBD,ARSLBD,RSHINE,
                          PTHOSB,SMPCAL,SLUNAR,TERMPR,PLMSUB,IOERR,
                          MOLPBD,COUPLE,MLSCAT,DPLDT,XPNDAR,INTEG,
                          INDXBK,KDISTR,ATMPRN,BCKPRN,FILTER,ZROINT,
                          ATMSBD,DISPRN
```

SUBROUTINE PRCALC (continued)

Local Variable Declarations:

```
      INTEGER           I,K,L,M,N,MM,IZ,KL,LB,IOS,ITYP1,MM1,NLNTOT,
                          KSCENE(MAXLAT,MAXLON),LPS,LPL,KK,LL,NVP,IP,
                          KDV1,KDV2,LLB,ISTOR1,IGEOM,NLOCAT,NSLTOT
      REAL              XN(NGAS,NNNMAX),RDSLSP(NAZMAX,MLMX2,2),V,
                          ACNP(NGAS,NNNMAX),ACND(NGAS,NNNMAX),TNOON,
                          COMA(NGAS,NNNMAX),FLTR,TAUPLM(NGAS),V1P,V2P,
                          S1(ISMX),S2(ISMX),S3(ISMX),SOLX,S4(ISMX),
                          S5(ISMX),S1T(ISMX),S2T(ISMX),RTH,RSL,SLTSC,
                          DRADP2,S3T(ISMX),S4T(ISMX),TAUX,AZL,XLUN,
                          S5T(ISMX),RADSLP(NAZMAX,MLMX2),DV,TMIDN,
                          RADLNP(NAZMAX,MLMX2),PROJS(6,NAZMAX,NGMAX),
                          PROJL(6,NAZMAX,NGMAX),HSKYSH,HSCATT,COMAE,
                          DRADP(NAZMAX,MLMX2),RADPTH(NAZMAX,MLMX2,2),
                          SIGMEP(NAZMAX,MLMX2),TAUSCP(NAZMAX,MLMX2),
                          PHIBM(NAZMAX),SOLAZP,AZS,BW,BWL,RDSCVS,
                          CNTCO2,CC,RDSCVL,RR2X(NAZMAX),CNTH2O,RDLNSP,
                          TAULR(NAZMAX,MLMX2),BKSUMV(6,NMATL,NAZMAX),
                          ALNTAU,BLNTAU,TAUUMG,TAUTRC,TAUHSC,TAUHAB,
                          TSLS,TSLB,AZO,RADSLS(NZSMAX,NASMAX),
                          RADLNS(NZSMAX,NASMAX),S6(ISMX),S6T(ISMX),
                          AZIMP(NAZMAX),SHDWS(NAZMAX,NGMAX),
                          SHDWL(NAZMAX,NGMAX)
      DOUBLE PRECISION  XS(ISMX),XST(ISMX),SCT1S,SCT1L,SCT3S,SCT3L,
                          TAUL(MLMX2),TAULA(MLMX2)
      LOGICAL           FLBCKZ(NGMAX),FLTRUE

COMMON Blocks:          /AEROSL/,/ARSLSC/,/ATMDAT/,/BCKDAT/,/CONSTN/,
                          /CURGDA/,/CURGDB/,/CURGDC/,/DEVICE/,/FLAGS/ ,
                          /INITAL/,/INTSTO/,/HEADER/,/KDISDT/,/LYRSTO/,
                          /MOLCON/,/MOLECP/,/MSPARM/,/OPTDEP/,/PATH1/ ,
                          /PATH1A/,/PATH4/ ,/PATH5A/,/PATH5B/,/PATH5C/,
                          /PATH5D/,/PATH6/ ,/PATH8/ ,/TRANSP/
```

SUBROUTINE PRETEM

Argument Declarations:

```
T      - REAL Vector (Len = Unspecified) (Output) - Temperature (K)
P      - REAL Vector (Len = Unspecified) (Output) - Pressure (mb)
ZP     - REAL Vector (Len = Unspecified) (Output) - Altitude (m)
           versus pressure
UP     - REAL Vector (Len = Unspecified) (Output) - H2O density
           (scaled LOWTRAN units) versus pressure
VP     - REAL Vector (Len = Unspecified) (Output) - CO2 density
           (scaled LOWTRAN units) versus pressure
WP     - REAL Vector (Len = Unspecified) (Output) - O3 density
           (scaled LOWTRAN units) versus pressure
HB     - REAL Variable (Input) - Terrain altitude (km)
CLALTB - REAL Vector (Len = Unspecified) (Input) - Cloud base altitudes (km)
           1 - Low etage
           2 - Middle etage
           3 - High etage
CLALTT - REAL Vector (Len = Unspecified) (Input) - Cloud top altitudes (km)
           1 - Low etage
           2 - Middle etage
           3 - High etage
TAIRLC - REAL Variable (Input) - Surface air temperature (K)
PAIRLC - REAL Variable (Input) - Surface air pressure (mb)
CH2OLC - REAL Variable (Input) - Surface water vapor content (ppmv)
KK     - INTEGER Variable (Input) - Latitude index
LL     - INTEGER Variable (Input) - Longitude index
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,MOLMAX,MLIDMX
      PARAMETER        (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MAXLAT=3, MAXLON=1, NGMAX=15, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,INT,LOG,MAX,MIN,ABS
      EXTERNAL         MOLPBD
```

Local Variable Declarations:

```
      INTEGER          J,K,IP,IP1,IP2,IL,J2,JMAX,JPMAX
      REAL             ALTLAY(10),HP,DELZ,DELZIP,P0,T0,DENSJ,DENSJP,
                         DP,T1,P1,H1,T2,P2,H2,FAC
```

COMMON Blocks: /CLIMAT/,/CONSTN/,/INITAL/,/MOLCON/

SUBROUTINE PROFAC

Argument Declarations:

X0	- REAL Variable (Input) - Value of X for which interpolation will be performed
X	- REAL Vector (Len = Unspecified) (Input) - X-array (must be monotonically increasing
N	- INTEGER Variable (Input) - Dimension of X-array
KEY	- INTEGER Variable (Output) - Position in X-array for which the X0-value is adjacent
FAC	- REAL Variable (Output) - The proportional factor for interpolation

INTRINSIC and EXTERNAL Declarations:

INTEGER	IBNSRC
INTRINSIC	MAX,MIN,ABS
EXTERNAL	IBNSRC

Local Variable Declarations:

INTEGER	KEYP
REAL	DX

COMMON Blocks: /CONSTN/

SUBROUTINE PROMPT

Argument Declarations:

STRING - CHARACTER*(*) Variable - Prompt request

Local Variable Declarations: None

COMMON Blocks: None

SUBROUTINE PRTHDR

Argument Declarations:

NFILE - INTEGER Variable (Input) - Device number

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           K,L,M,IOS,KK,LL,MM,IV,IGEOM
```

COMMON Blocks: /HEADER/

SUBROUTINE PTHOSB

Argument Declarations:

L - INTEGER Variable (Input) - Location in integration
TAUL - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Transmittance along observer-source-background path
TAULA - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Transmittance due to absorption along the observer-source-background path
RADPTH - REAL Variable (Output) - Path thermal radiance ($W/cm^2/sr/cm^{-1}$)
DRADB2 - REAL Variable (Output) - Variance in path thermal radiance $(W/cm^2/sr/cm^{-1})^2$
RR2X - REAL Variable (Input/Output) - Second integral in EXPIRT for scattering case ($W/cm^2/sr/cm^{-1}$)
TAUSCP - REAL Variable (Input/Output) - Transmittance, including scattered out of the beam, but still received by the observer
PTHFAC - REAL Array (Len = MAXLAT x Unspecified) (Input) - Proportionality factor for multiple atmospheres
NPTH - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits for non-zero elements of PTHFAC

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,NAZMAX,NBAND,ISMX,NANG,MAXLAT,
                          MAXLON,NGMAX,NASMAX,NZSMAX,NVSMAX,MOLMAX,
                          MLIDMX
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX, NAZMAX=30, NGMAX=15)
      PARAMETER         (NBAND=16, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NASMAX=15, NZSMAX=4, NANG=65, MLIDMX=45)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RADTRX
      INTRINSIC         REAL,DPROD,ABS,COS,SQRT,DBLE,ATAN2,EXP,MAX
      EXTERNAL          RADTRX
```

Local Variable Declarations:

```
      INTEGER           K,KL,KLM,KK,LL,LX
      REAL              DUM,ACCZ,DUMP,ASYMT,SCTZ1,SCTZ2
      DOUBLE PRECISION  PLK1,PLK2,DPLK1,DPLK2,DELTAU,SUMP,SUM
```

```
COMMON Blocks:          /ARSLSC/,/CONSTN/,/CURGDC/,/HEADER/,/INITAL/,
                          /LYRSTO/,/MOLECP/,/PATH1/,/PRBNDA/
```

SUBROUTINE PTHTAU

Argument Declarations:

- N - INTEGER Variable (Input) - Number of increments along path
- ITL - INTEGER Vector (Len = Unspecified) (Input) - Point in altitude grid for each path increment
- DR - REAL Vector (Len = Unspecified) (Input) - Length of each incremental path segment (km)
- XS - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Optical depth
- S1 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Lorentz halfwidth times line density
- S2 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Doppler halfwidth times line density
- S3 - REAL Vector (Len = Unspecified) (Input) - Summing variable for line density
- S4 - REAL Vector (Len = Unspecified) (Input) - Summing variable for the continuum
- S5 - REAL Vector (Len = Unspecified) (Input) - Summing variable for scattering
- S6 - REAL Vector (Len = Unspecified) (Input) - Summing variable for (Lorentz halfwidth)^2 times line density
- TAUF - REAL Variable (Output) - Transmittance for the whole path
- TAU - DOUBLE PRECISION Vector (Len = Unspecified) (Output) - Transmittances at each point along path (i.e., an incremental set of transmittances)
- TAUA - DOUBLE PRECISION Vector (Len = Unspecified) (Output) - Transmittance due to absorption
- ITYPE - INTEGER Variable (Input) - Calculation index
  ITYPE = 0 implies that only the final transmittance is calculated
  ITYPE = 1 implies that incremental transmittance is calculated
- ISTORE - INTEGER Variable (Input) - Storage index
  ISTORE = 0 implies no intermediate storage
  ISTORE = 1 implies intermediate storage required
- PTHFAC - REAL Array (Dim = MAXLAT MAXLON x Unspecified) (Input) - Proportionality factor for path
- NPTH - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits for non-zero elements of PTHFAC
- FLTRN - LOGICAL Variable (Input) - Flag for storing component transmission values
- N0 - INTEGER Variable (Input) - Increment for which transmission values are to be stored
- MM - INTEGER Variable (Input) - Azimuth index
- DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,ISMX,MAXLAT,MAXLON,MOLMAX,MLIDMX
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MAX,REAL,DPROD
      EXTERNAL          TRNSMT,BNTPTH
```

Local Variable Declarations:

```
      INTEGER           K,L,LM,KL,KLM,KK,LL
      REAL              S1P(ISMX),S2P(ISMX),S3P(ISMX),S4P(ISMX),DUM3,S5P(ISMX),
                          DELTAU,DUMSD,DUMCD,DUMSC,DUM1,DUM2,DR2,DUM4,S6P(ISMX)
      DOUBLE PRECISION  XSP(ISMX),TAUD,SCFD
      LOGICAL           FLAG
```

```
COMMON Blocks:          /CONSTN/,/CGWTS/,/CURGDA/,/CURGDB/,/CURGDC/,
                          /MOLECP/,/OPTDEP/,/PRBNDA/,/PRBNDB/
```

SUBROUTINE PUTCLD

Argument Declarations: None

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          CHRCBD,DEVCBD,CLDRBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           IOS,K,KK,LL
```

COMMON Blocks: /CHRCNM/,/CLDRN/ ,/DEVICE/,/HEADER/

SUBROUTINE PUTHDR

Argument Declarations:

INITV - INTEGER Variable (Input) - Initial value for spectral loop. For standard calculations, INITV = 1. For restart calculations, it provides the value at which to restart.
LATST - REAL Vector (Len = Unspecified) (Input) - Latitude grid
LONST - REAL Vector (Len = Unspecified) (Input) - Longitude grid
MTIME - INTEGER Variable (Input) - Number of temporal variables

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGAS,MLMAX,ISMX,NGMAX,NZSMAX,NBAND,
                          MAXLAT,MAXLON,NVSMAX,MOLMAX,MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLIDMX=45)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, NGAS=6, NBAND=16)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         REAL
      EXTERNAL          PRTHDR,IOERR,DEVCBD,MOLPBD
```

Local Variable Declarations:

```
      INTEGER           L,NVARA(NGMAX),NVARB(NGMAX),NVARP(NGMAX),KK,LL,
                          NVARM(NGMAX),NVARH(NGMAX),NVART(NGMAX),IG,
                          NVH(NVSMAX),NHDR(2),NHDRB(2),NHDRM(2),ITP,
                          NHDRH(2),IZ,IOS,IGEOM,NGEOMH,NVSETH
```

COMMON Blocks: /BCKDAT/,/DEVICE/,/HEADER/,/INITAL/,/MOLCON/,
/MOLECP/

SUBROUTINE PUTSLR

Argument Declarations: None

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SLRCNT
      CHARACTER*72      IOERR
      EXTERNAL          SLRCNT,DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           IOS
      REAL              SLRC
      CHARACTER*8       LOCAT(2)
```

COMMON Blocks: /DEVICE/,/FLAGS/ ,/HEADER/

REAL FUNCTION RAB

Argument Declarations:

```
  R1      - REAL Variable - Diffuse reflection coefficient, layer 1
  R1S     - REAL Variable - Directional reflection coefficient, layer 1
  R2      - REAL Variable - Diffuse reflection coefficient, layer 2
  R2S     - REAL Variable - Directional reflection coefficient, layer 2
  R3      - REAL Variable - Diffuse reflection coefficient,layer 3
  T2      - REAL Variable - Transmission, layer 2
  T3      - REAL Variable - Transmission, layer 3
  G       - REAL Variable - Composite R and T from FUNCTION GAM
```

Local Variable Declarations:

```
      REAL              T,TT
```

COMMON Blocks: None

REAL FUNCTION RADFLD

Argument Declarations:

```
  TEMP    - REAL Variable - Temperature (K)
  V       - REAL Variable - Wavenumber (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DPROD,EXP
```

Local Variable Declarations:

```
      REAL              TREF
      DOUBLE PRECISION  DUM,DUM0
```

COMMON Blocks: None

REAL FUNCTION RADTRX

Argument Declarations:

```
  Y1      - DOUBLE PRECISION Variable - Value of Y(X1)
  X1      - DOUBLE PRECISION Variable - Initial point of integration
  Y2      - DOUBLE PRECISION Variable - Value of Y(X2)
  X2      - DOUBLE PRECISION Variable - Final point of integration
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         LOG,ABS,MAX,MIN,REAL
```

Local Variable Declarations:

```
      DOUBLE PRECISION DX1,DX2,DY1,DY2,XLNX,XLNY
```

COMMON Blocks: /CONSTN/

REAL FUNCTION RADTRY

Argument Declarations:

```
  Y1      - DOUBLE PRECISION Variable - Value of Y(X1)
  Y2      - DOUBLE PRECISION Variable - Value of Y(X2)
  DX      - DOUBLE PRECISION Variable - Increment of integration
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         LOG,ABS,REAL,MAX
```

Local Variable Declarations:

```
      DOUBLE PRECISION DY1,DY2,XLNY
```

COMMON Blocks: /CONSTN/

REAL FUNCTION RAINEX

Argument Declarations:

```
  RATE   - REAL Variable - Rain rate (mm/hr)
  ITYPE  - INTEGER Variable - Type of distribution
             ITYPE = 1 implies a Marshall-Palmer distribution
             ITYPE = 2 implies a Drizzle (Joss and Waldvogel)
             ITYPE = 3 implies a Widespread rain (Joss and Waldvogel)
             ITYPE = 4 implies a Thunderstorm (Joss and Waldvogel)
             ITYPE = 5 implies a Thunderstorm (Sekhon and Srivastava)
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          RAINBD
```

Local Variable Declarations:

```
      REAL              XN,ALPH
```

COMMON Blocks: /CONSTN/,/RAINTP/

SUBROUTINE RAINSP

Argument Declarations:

```
  WL     - REAL Variable (Input) - Wavelength (μm)
  RATE   - REAL Variable (Input) - Rain rate (mm/hr)
  TEMP   - REAL Variable (Input) - Temperature (K)
  IRAIN  - INTEGER Variable (Input) - Type of rain distribution
             IRAIN = 1 implies a Marshall-Palmer Distribution
             IRAIN = 2 implies a drizzle (Joss and Waldvogel)
             IRAIN = 3 implies a widespread rain (Joss and Waldvogel)
             IRAIN = 4 implies a thunderstorm (Joss and Waldvogel)
             IRAIN = 5 implies a thunderstorm (Sekhon and Srivastava)
  RNABS  - REAL Variable (Output) - Normalized absorption coefficient
  RNSCT  - REAL Variable (Output) - Normalized scattering coefficient
```

PARAMETER Declarations:

```
      INTEGER           NWLCLD
      PARAMETER         (NWLCLD=79)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         MIN
      EXTERNAL          PROFAC,XTERP,CLDRBD,RAINBD
```

Local Variable Declarations:

```
      INTEGER           KEYWL,KEYWLP,ITYPE,KEYTP,KEYTPP,NVAR7,ITRP0
      REAL              RATEFF,RA1,RA2,RX1,RX2,FACWL,FACTP,RA11,RA12,
                          RA21,RA22,RX11,RX12,RX21,RX22
```

COMMON Blocks: /CLDRN/ ,/RAINTP/,/RAINWL/

SUBROUTINE RAYPTH

Argument Declarations:

```
  L1      - INTEGER Variable (Input) - Altitude index for the initial
              point of the ray
  L2      - INTEGER Variable (Input) - Altitude index for the final
              point of the ray
  PHI1    - DOUBLE PRECISION Variable (Input) - Elevation angle at the
              initial point of the ray (rad)
  LENP    - INTEGER Variable (Input) - Index for path length
              LENP = 0 implies the short path
              LENP = 1 implies the long path (if it exists)
  R       - REAL Vector (Len = Unspecified) (Output) - Array of
              cumulative slant ranges along the ray (km)
  PHI     - REAL Vector (Len = Unspecified) (Output) - Array of
              elevation angles along the ray (rad)
  THETA   - REAL Vector (Len = Unspecified) (Output) - Array of
              earth-center angles along the ray (rad)
  IZ      - INTEGER Vector (Len = Unspecified) (Output) - Array of
              altitude indices along the ray
  KL      - INTEGER Variable (Output) - Number of elements in the
              arrays R, PHI, THETA, and IZ
  KLMAX   - INTEGER Variable (Input) - DIMENSION of R, PHI, THETA, and IZ
  IBKGD   - INTEGER Variable (Output) - Background index
              Note - If ray path terminates at a point other than L2,
                     the input value is changed so that IBKGD = -3 if
                     the ray terminates in space, and IBKGD = -4 if
                     the ray terminates on the earth (i.e., L = 1)
  HTNGT   - REAL Variable (Input/Output) - Tangent altitude (km)
  NLAT    - INTEGER Variable (Input) - Number of latitudes
  NLON    - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,MAXLAT,MAXLON,NGMAX,MOLMAX
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,INT,COS,ACOS,SIN,DBLE,SIGN,ABS,MAX,MIN
      EXTERNAL          TANGPT
```

Local Variable Declarations:

```
      INTEGER           J,K,JP,JM,JMM,ICHK,IDRCT,KLAT,KLON
      DOUBLE PRECISION SNELL,PX1,PX2,MH,MHP,XDRCT,RD,RX,TD,DZ,DPHI1,
                         DPHI2,PX0,DFAC,XMH0,DXMH1,DXMH2
```

COMMON Blocks: /INITAL/

REAL FUNCTION RBE

Argument Declarations:

```
  R1     - REAL Variable - Diffuse reflection coefficient, layer 1
  R1S    - REAL Variable - Directional reflection coefficient, layer 1
  R2     - REAL Variable - Diffuse reflection coefficient, layer 2
  R2S    - REAL Variable - Directional reflection coefficient, layer 2
  R3     - REAL Variable - Diffuse reflection coefficient,layer 3
  R3S    - REAL Variable - Directional reflection coefficient, layer 3
  T3     - REAL Variable - Transmission, layer 3
  T2     - REAL Variable - Transmission, layer 2
  G      - REAL Variable - Composite R and T from FUNCTION GAM
```

Local Variable Declarations:

```
      REAL              T,TT
```

COMMON Blocks: None

SUBROUTINE RDFLTR

Argument Declarations:

```
  IFLTR  - INTEGER Variable (Input/Output) - Filter index
             For now, it is 1 for all user-defined filters.
  TFLTR  - CHARACTER*(*) Variable (Output) - Name of filter response
             This name is printed out on the ASCII printout.
```

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           LENSTR
      REAL              GETVAR
      CHARACTER*2       LWCASE
      CHARACTER*3       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         MIN
      EXTERNAL          DEVCBD,RDLINE,PARSE,GETVAR,UPCASE,IOERR,INFLBD,
                          LCTRIM,LENSTR,LWCASE
```

Local Variable Declarations:

```
      INTEGER           I,IOS,NDATA,ICOL0,ICOL40,NVAR3,KODE,NW,NF,IFT,
                          IPRINT,NLOW,NEW,LENF,IFWV
      REAL              TEMP
      CHARACTER*1       DOT
      CHARACTER*20      VRDATA(3),IDFIL
      CHARACTER*80      TITLE,DUMMY
      CHARACTER*255     VARIAB
```

COMMON Blocks: /DEVICE/,/FLTRDT/,/INFLTR/

SUBROUTINE RDGBL

Argument Declarations:

```
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLONG  - REAL Variable (Input) - Longitude (deg)
  MONTH  - INTEGER Variable (Input) - Month of year
  GMT    - REAL Array (Dim = 2 x Unspecified) (Output) - Time (GMT dec. hr.)
  TSRF   - REAL Array (Dim = 2 x Unspecified) (Output) - Surface temperature
           (K)
  CLCV   - REAL Array (Dim = 2 x 0:3 x Unspecified) (Output) - Cloud cover (%)
  CIRR   - REAL Variable (Output) (Output) - Percentage cirrus clouds (%)
  CLDRAD - REAL Array (Dim = 2 x 3 x Unspecified) (Output) - Cloud
           radiance (μW/cm²/sr)
  FRSNW  - REAL Variable (Output) (Output) - Percentage snow cover (%)
  FRICE  - REAL Variable (Output) (Output) - Percentage ice (%)
```

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             SEAICE
      CHARACTER*72     IOERR
      INTRINSIC        MOD,INT,INDEX,LEN
      EXTERNAL         DEVCBD,IOERR,SEAICE
CIBMV EXTERNAL         FILEINF
```

Local Variable Declarations:

```
      INTEGER          I,J,K,IREC,NREC(40),IOS,IPRINT,IXM
CIBMV INTEGER          IERR
      REAL             YLONG,YLAT(41),DLON(40),ZLAT,ZLONG,TERR
      LOGICAL          FLGBL
      CHARACTER*120    NFILE
```

COMMON Blocks: /DEVCNM/,/DEVICE/

SUBROUTINE RDLINE

Argument Declarations:

```
  IUNIT  - INTEGER Variable (Input) - Unit number
  ISKIP  - INTEGER Variable (Input) - Number of characters to be
             skipped on initial READ
  OUTBUF - CHARACTER*(*) Variable (Output) - Buffer for output
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          LENSTR
      CHARACTER*72     IOERR
      INTRINSIC        MAX,MIN,LEN
      EXTERNAL         LCTRIM,LENSTR,IOERR
```

Local Variable Declarations:

```
      INTEGER          I,K,ISTART,IEND,IMAXLN,IBUFLN,IOS,JMAXLN,KMAX,JSKIP
      CHARACTER*80     IBUFFR,TBUFFR
      LOGICAL          FIRST,CONTNU
```

COMMON Blocks: None

SUBROUTINE RDSCN

Argument Declarations:

```
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLONG  - REAL Variable (Input) - Longitude (deg)
  ALT    - REAL Variable (Output) - Altitude (m)
  IBK    - INTEGER Variable (Output) - Scene index
  FRWTR  - REAL Variable (Output) - Fraction surface water in scene
```

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          IBKCNV
CIBM  INTEGER          IBITS
CVAX  INTEGER          JIBITS
CLAH  INTEGER          JIBITS
      CHARACTER*72     IOERR
      INTRINSIC        MOD,INT,MAX,MIN,INDEX,ABS,LEN
CMIL  INTRINSIC        IBITS
CVAX  INTRINSIC        JIBITS
CLAH  EXTERNAL         JIBITS
CIBM  EXTERNAL         IBITS
      EXTERNAL         DEVCBD,IOERR,IBKCNV,CITIES
CIBMV EXTERNAL         FILEINF
```

Local Variable Declarations:

```
      INTEGER          I,J,IREC,IOS,NLAT,LAT,LON,IPRINT,IXM,
                       LATMIN,LONMIN,IECO
CMIL  INTEGER          IFLD(6,6),IFLDV
      INTEGER*1        JBK(6,6),IWTR(6,6)
CINT2 INTEGER*2        JBK(6,6),IWTR(6,6)
      INTEGER*2        IALT(6,6)
CINT4 INTEGER          JBK(6,6),IWTR(6,6),IALT(6,6)
CIBMV INTEGER          IERR
      REAL             YLONG
      LOGICAL          FLSCN,FLURB
      CHARACTER*120    NFILE,URBNAM

COMMON Blocks:         /DEVCNM/,/DEVICE/
```

COMPLEX FUNCTION REFEST

Argument Declarations:

```
  REFL   - REAL Variable - Normal reflection coefficient
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        SQRT,CMPLX,ABS,MAX
```

Local Variable Declarations:

```
      REAL             N,K,DUM

COMMON Blocks:         /CONSTN/
```

DOUBLE PRECISION FUNCTION REFRAC

Argument Declarations:

```
  PRESS  - REAL Variable - Atmospheric pressure (mb)
  TEMP   - REAL Variable - Atmospheric temperature (K)
  WH2O   - REAL Variable - Volume mixing ratio, water vapor (ppm)
  WCO2   - REAL Variable - Volume mixing ratio, carbon dioxide (ppm)
  WO2    - REAL Variable - Volume mixing ratio, oxygen (ppm)
  WL     - REAL Variable - Wavelength (μm)
  REARTH - DOUBLE PRECISION Variable - Radius of the earth (km)
  ALT    - REAL Variable - Altitude (km)
             If refractivity is desired, input ALT = 0.0; otherwise
             modified refractivity is returned.
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SUPK,PFR
      INTRINSIC         EXP,DBLE,SQRT
      EXTERNAL          SUPK,PFR,REFRBD
```

Local Variable Declarations:

```
      INTEGER           L,N2
      REAL              PH2O,PCO2,PO2,PNRT,V,WCD,CT,CA,SA,GA,PHI,XIF,
                          PRFL,GAMMA,GAMNR,FREQ
      DOUBLE PRECISION N0(3),RTOT,DISP,EPS,S,DENS0(3),DENS
```

COMMON Blocks: /MMWREF/

REAL FUNCTION RELHUM

Argument Declarations:

```
  CH2O   - REAL Variable - Water vapor concentration (ppmv)
  PRESS  - REAL Variable - Pressure (mb)
  TEMP   - REAL Variable - Temperature (K)
  ITYPE  - INTEGER Variable - Type of saturation
             ITYPE = 0 implies water vapor
             ITYPE = 1 implies ice
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              SATUR
      EXTERNAL          SATUR
```

Local Variable Declarations:

```
      REAL              R,RW,EW,RATIO,WH2O,WAIR
```

COMMON Blocks: None

SUBROUTINE RESOLV

Argument Declarations:

```
  VI      - REAL Variable (Input) - Initial wavenumber (cm-1)
  VF      - REAL Variable (Input/Output) - Final wavenumber (cm-1)
  DVI     - REAL Variable (Input) - Initial wavenumber increment (cm-1)
  IDV     - INTEGER Variable (Input) - Wavenumber/wavelength index
              IDV = 1 implies wavenumber (cm-1)
              IDV = 2 implies wavelength (micron)
              IDV = 3 implies frequency (GHz)
  DWL     - REAL Variable (Input) - Wavelength increment (micron)
  DV      - REAL Variable (Output) - Wavenumber increment (cm-1)
  IV      - INTEGER Variable (Input/Output) - Index for VF
  ITYPE   - INTEGER Variable (Input) - Calculation index
              ITYPE = 1 implies that DV and IV are calculated for VF
              ITYPE = 2 implies that DV and VF are calculated for IV
                          (See note below)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              DVINCR
      EXTERNAL          DVINCR
```

Local Variable Declarations:

```
      INTEGER           I
      REAL              VX,DVP
```

COMMON Blocks: None

SUBROUTINE RSHINE

Argument Declarations:

IFSCR - INTEGER Variable (Input) - File number for skyshine solar path data
If IFSCR = 0, file is not OPEN
DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})
SOLX - REAL Variable (Input) - Exoatmospheric solar irradiance ($W/cm^2/cm^{-1}$)
XLUN - REAL Variable (Input) - Exoatmospheric lunar irradiance ($W/cm^2/cm^{-1}$)
XS - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Optical depth
S1 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Lorentz halfwidth times line density
S2 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Doppler halfwidth times line density
S3 - REAL Vector (Len = Unspecified) (Input) - Summing variable for line density
S4 - REAL Vector (Len = Unspecified) (Input) - Summing variable for the continuum
S5 - REAL Vector (Len = Unspecified) (Input) - Summing variable for scattering
S6 - REAL Vector (Len = Unspecified) (Input) - Summing variable for (Lorentz halfwidth)^2 times line density
SOLXM - REAL Array (Dim = NAZSMX x Unspecified) (Output) - Apparent solar radiance as a function of azimuth ($W/cm^2/cm^{-1}$)
XLNXM - REAL Array (Dim = NAZSMX x Unspecified) (Output) - Apparent lunar radiance as a function of azimuth ($W/cm^2/cm^{-1}$)
NAZSMX - INTEGER Variable (Input) - Maximum number of azimuths
V - REAL Variable (Input) - Wavenumber (cm^{-1})
IGEOM - INTEGER Variable (Input) - Geometry number

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,ISMX,NBAND,NZSMAX,NWLAER,NWLCLD,NANG,
                          MAXLAT,MAXLON,NAZMAX,NASMAX,NMATL,NGMAX,NVSMAX,
                          ISTMAX,MOLMAX
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, NBAND=16, NMATL=28)
      PARAMETER         (NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NWLAER=47, NWLCLD=79, NANG=65)
      PARAMETER         (NGMAX=15, NVSMAX=20, MAXLAT=3, MAXLON=1)
      PARAMETER         (ISTMAX=30000)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              RADTRX
      CHARACTER*72      IOERR
      INTRINSIC         DPROD
      EXTERNAL          SOLRAD,RADTRX,BNTPTH,ARSLBD,PTHTAU,MLSCAT,
                          BCKGND,TERMPR,IOERR
```

Local Variable Declarations:

```
      INTEGER           K,L,M,KK,LL,KL,MM,IOS,LPS,LPL,ITYP1,ISTOR1,
                          IGEOMP,MASP,NSHM
      REAL              S1P(ISMX),S2P(ISMX),S3P(ISMX),S4P(ISMX),RADSDM,
                          S5P(ISMX),RADSCM,RDSCML,DRSTOR,DSTORS,DSTORL,
                          RTHSH,RSLSH,DUMSUM(6,NMATL),RDSCV,CC,SOLAZP,
                          HSKYSH,HSCATT,PROJSH(6,1),PHISHD(1),AZS,AZL,
                          PROJLH(6,1),S6P(ISMX),SHDWS(1),SHDWL(1)
      DOUBLE PRECISION  XSP(ISMX),TAUL(MLMX2),TAULA(MLMX2),DELTAU,
                          PLK1,PLK2,SCT1S,SCT1L,SCT3S,SCT3L
```

```
COMMON Blocks:      /AEROSL/,/ARSLSC/,/CONSTN/,/CURGDA/,/CURGDB/,/CURGDC/,
                      /FLAGS/ ,/HEADER/,/INITAL/,/INTSTO/,/LYRSTO/,/OPTDEP/,
                      /PATH2/ ,/PATH2A/,/PATH2B/,/PATH2C/,/PATH2D/,/PATH4/
```

REAL FUNCTION SATUR

Argument Declarations:

```
  PRESS  - REAL Variable - Pressure (mb)
  TEMP   - REAL Variable - Temperature (K)
  ITYPE  - INTEGER Variable - Type of saturation
             ITYPE = 0 implies water vapor
             ITYPE = 1 implies ice
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         DBLE,REAL,LOG10
```

Local Variable Declarations:

```
      REAL              T0,TS,EI0,EWS,EX
      DOUBLE PRECISION  DTEMP
```

```
COMMON Blocks:          /CONSTN/
```

REAL FUNCTION SCINTL

Argument Declarations:

```
  VARX   - REAL Variable - Path-averaged turbulence (km)
  V      - REAL Variable - Wavenumber (cm-1)
  APERT  - REAL Variable - Aperture diameter (m)
  Z      - Real Variable - Distance over which turbulence is averaged (km)
```

PARAMETER Declarations:

```
      INTEGER           NPTS,MPTS
      PARAMETER         (NPTS=10, MPTS=14)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      INTRINSIC         MAX,MIN,EXP,SQRT
      EXTERNAL          PROFAC,XTERP
```

Local Variable Declarations:

```
      INTEGER           I,KEY,KEYP,ITRP1
      REAL              VAR,VAREX,CL0(NPTS),DNORM(MPTS),D0,XK,VAR0,
                          THETA(NPTS,MPTS),FACD,T1,T2,THETAD
```

```
COMMON Blocks:          /CONSTN/
```

SUBROUTINE SCNRIO

Argument Declarations:

```
  LENP   - INTEGER Variable (Input/Output) - Index for desired ray path in the
             case of any ambiguity
               LENP = 0 implies the shorter path
               LENP = 1 implies the longer path
  IGEOM  - INTEGER Variable (Input) - Geometry number
  IERR   - INTEGER Variable (Output) - Error index
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) - Switch
             for model atmospheres
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,ISMX,NAZMAX,NASMAX,ISTMAX,MLIDMK,
                          NGMAX,NZSMAX,NL,MAXLAT,MAXLON,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (ISTMAX=30000)
      PARAMETER         (NL=50)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,MAX,MIN,ABS,DBLE,TAN,COS,ACOS,SIN,MOD
      EXTERNAL          GEOM,RAYPTH,CALEND,HOREQU,EQUECL,ECLGAL,HORIZN,
                          TURBUL,SPTRIG,DEFBCK,INTR2D,ATMSBD,MOLPBD,
                          SHNGEO
```

Local Variable Declarations:

```
      INTEGER           KL,K,L,LM,IDAYX,LENB,JBKGD,LTERM,ITP,KK,LL,
                          KLMAXP,LB,IHORSB,KSW,NLOCAT,MM,LINIT,IPRINT,
                          MLAT,MLON,ITYP0
      REAL              DYEAR,PHOS,RHOS,BHOS,SRMAX,THD,BETMAX,PHIOR,
                          PHISR,XLEQUT,BEQUT,AZP,SOLAZP,RSOLAR,
                          RLUNAR,ELP,HSEND,XLT,AZDUM(NAZMAX),MHP
      DOUBLE PRECISION  PHITX
```

```
COMMON Blocks:          /ATMDAT/,/BCKDAT/,/CONSTN/,/FLAGS/ ,/HEADER/,
                          /INITAL/,/MOLCON/,/MOLECP/,/PATH1/ ,/PATH1A/,
                          /PATH4/ ,/PATH5A/,/PATH5B/,/PATH5C/,/PATH5D/
```

REAL FUNCTION SEAICE

Argument Declarations:

```
  XLAT   - REAL Variable - Latitude (deg)
  XLON   - REAL Variable - Longitude (deg)
  IMONTH - INTEGER Variable - Month of year
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MOD,INT,MAX,MIN
      EXTERNAL          SICEBD
```

Local Variable Declarations:

```
      INTEGER           L,LAT,LON,IM,IX
      REAL              FRICE(12),YLONG
```

COMMON Blocks: /SICEDT/

REAL FUNCTION SEATMP

Argument Declarations:

```
  MONTH  - INTEGER Variable - Month of year (MONTH = 1 implies Jan)
  XLAT   - REAL Variable - Latitude (+ North, - South) (deg)
  XLONG  - REAL Variable - Longitude (+ East, - West) (deg)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         INT,MAX,MIN
      EXTERNAL          OCNTBD
```

Local Variable Declarations:

```
      INTEGER           ISEASN(12),ILAT,ILON
      REAL              YLONG
```

COMMON Blocks: /TMPOCN/

COMPLEX FUNCTION SEAWTR

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  TEMP   - REAL Variable - Temperature (K)
```

Local Variable Declarations:

```
      INTEGER           N,M
      REAL              T0(4),WAVE,DEL1(4),DELB,SIG1(4),SIGB,EP,A,FREQ
      COMPLEX           IX,JX
```

COMMON Blocks: None

SUBROUTINE SETALT

Argument Declarations:

```
  ZP     - REAL Vector (Len = Unspecified) (Input/Output) - Basic altitude
             grid (km)
  NLP    - INTEGER Variable (Input/Output) - Number of points in basic grid
  HXTRA  - REAL Vector (Len = Unspecified) (Input/Output) - Extra altitudes in
             altitude grid (km)
  NXTRA  - INTEGER Variable (Input/Output) - Dimension of HXTRA
  HRI    - REAL Vector (Len = Unspecified) (Input) - Observer altitude (km)
  HTI    - REAL Vector (Len = Unspecified) (Input) - Source altitude (km)
  NGEOM  - INTEGER Variable (Input) - Number of geometry conditions
  HBCK   - REAL Variable (Input) - Terrain altitude (km)
  ICLDRN - INTEGER Variable (Input) - Cloud index
  ZCLD   - REAL Vector (Len = Unspecified) (Input) - Cloud altitude grid (km)
  CLDBS  - REAL Variable (Input) - Cloud base altitude (km)
  CLDTP  - REAL Variable (Input) - Cloud top altitude (km)
  HPRF   - REAL Vector (Len = Unspecified) (Input) - Beginning and ending
             altitudes for background (km)
  ZBCK   - REAL Vector (Len = Unspecified) (Output) - Background altitude
             points (km)
  TBCK   - REAL Array (Dim = MLMX x MAXLAT x Unspecified) (Output) -
             Background temperatures (K)
  LBCK   - INTEGER Vector (Len = Unspecified) (Output) - Background
             altitude indices (km)
  NBCKZ  - INTEGER Variable (Output) - Number of background altitude points
  MT     - INTEGER Array (Dim = MAXLAT x Unspecified) (Input) - Model
             temperature profile index
  MLMX   - INTEGER Variable (Input) - Maximum number of altitude layers for
             TBCK
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,ISMX,NASMAX,NL,MAXLAT,MAXLON,NGMAX,NLUPR,
                         NTEXO,MOLMAX
      PARAMETER        (MLMAX=140, NASMAX=15, NL=50)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MAXLAT=3, MAXLON=1, NGMAX=15, NLUPR=8)
      PARAMETER        (NTEXO=11)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP
      INTRINSIC        MAX,MIN,ABS,REAL,DBLE
      EXTERNAL         XTERP,UPPRBD,ATMSBD
```

Local Variable Declarations:

```
      INTEGER          I,J,L,NLX,KK,LL,ITRP0,MTX
      REAL             H1,ZPX
```

COMMON Blocks: /ATMDAT/,/CONSTN/,/INITAL/,/UPRATM/,/USERDF/

SUBROUTINE SETBCK

Argument Declarations:

```
  ITYPE  - INTEGER Variable (Input) - Scene index
             Refer to User Reference Manual for definition
  SNOW   - REAL Variable (Input) - Percentage snow (%)
  ICE    - REAL Variable (Input) - Percentage ice (%)
  WATER  - REAL Variable (Input) - Percentage water (%)
```

PARAMETER Declarations:

```
      INTEGER          NMATL,NSCEN,NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,
                         MAXLON,ISMX,NVSMAX,NL,MOLMAX
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (NMATL=28, NSCEN=35, NL=50)
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL         BKGDBD,SCENBD,MODBCK,INTR2D,ATMSBD
```

Local Variable Declarations:

```
      INTEGER          I,ISTORE,KK,LL
      REAL             FRCTN,TAIRP,PTHFAC(MAXLAT,MAXLON)
```

COMMON Blocks: /ATMDAT/,/BACKGD/,/HEADER/,/SCENES/

SUBROUTINE SETFLG

Argument Declarations:

```
  ISOLAR - INTEGER Variable (Input) - Solar index
  ILUNAR - INTEGER Variable (Input) - Lunar index
  IEPHEM - INTEGER Variable (Input) - Ephemeris index
  ISMPLS - INTEGER Variable (Input) - Type of solar calculation
  ISMPLL - INTEGER Variable (Input) - Type of lunar calculation
  IVSA   - INTEGER Variable (Input) - Vertical structure index
  IFATM  - INTEGER Variable (Input) - Atmosphere file number
  IFBCK  - INTEGER Variable (Input) - Background file number
  IFBSW  - INTEGER Variable (Input) - Fore/Background altitude switch
  IGMSW  - INTEGER Variable (Input) - Geometry type index
  IFMSC  - INTEGER Variable (Input) - Multiple scattering index
```

PARAMETER Declarations:

```
      INTEGER          NGMAX
      PARAMETER        (NGMAX=15)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /FLAGS/

SUBROUTINE SETUP

Argument Declarations:

```
  L1     - INTEGER Variable (Output) - Location of start of ray in
             altitude array
  LSH    - INTEGER Variable (Output) - Location of termination of
             ray in altitude array
  PHISHR - DOUBLE PRECISION Variable (Output) - Initial elevation
             angle for ray (rad)
  ITERM  - INTEGER Variable (Output) - Terminator index
             Refer to User Reference Manual for definition
  LBKGD  - INTEGER Variable (Input) - Location of background
             altitude in altitude array
  LTRGT  - INTEGER Variable (Input) - Location of target altitude
             in altitude array
  PHISH  - REAL Variable (Input) - Initial elevation angle for ray (deg)
  PHIHOR - REAL Variable (Input) - Elevation angle to horizon (deg)
  IBKGD  - INTEGER Variable (Input) - Background index
             Refer to User Reference Manual for definition
  ML     - INTEGER Variable (Input) - Number of altitudes in altitude array
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        DBLE
```

COMMON Blocks: /CONSTN/

REAL FUNCTION SHADOW

Argument Declarations:

```
  PHI1   - REAL Variable - Incident elevation angle (deg)
  PHI2   - REAL Variable - Reflected elevation angle (deg)
  THETA  - REAL Variable - Azimuth (deg)
  SLOPE  - REAL Variable - Mean slope of the roughness
```

INTRINSIC and EXTERNAL Declarations:

```
      DOUBLE PRECISION DERF
      INTRINSIC        SQRT,EXP,COS,SIN,ABS,REAL,DBLE,MOD,MAX
      EXTERNAL         DERF
```

Local Variable Declarations:

```
      DOUBLE PRECISION A1,A2,B1,B2,X1,X2,SLOPE1,SLOPE2,DUM,THETP,DUMM
```

COMMON Blocks: /CONSTN/

SUBROUTINE SHNGEO

Argument Declarations:

```
  SRC    - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Vector to
             sun/moon from earth center
  SCTPT  - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Vector to
             scattering point from earth center
  ELEV   - REAL Variable (Input) - Elevation angle of ray at scattering
             point (deg)
  AZIM   - REAL Variable (Input) - Azimuth angle of ray at scattering point
             (deg)
  XLAT   - REAL Variable (Input) - Latitude of scattering point (deg)
  XLON   - REAL Variable (Input) - Longitude of scattering point (deg)
  IZL    - INTEGER Variable (Input) - Altitude index of scattering point
  LSRC   - INTEGER Variable (Input) - Altitude index of sun/moon
  SCTANG - REAL Variable (Output) - Scattering angle (deg)
  NDXSR  - INTEGER Variable (Input) - Index for starting position of a
             given ray in the IZLSH and DRZLSH vectors
  NTBSR  - INTEGER Variable (Output) - Number of elements in the
             IZLSH and DRZLSH vectors for each ray
  IZLSH  - INTEGER Vector (Len = Unspecified) (Output) - Altitude indices
             for the ray
  DRZLSH - REAL Vector (Len = Unspecified) (Output) - Path length
             segments for the ray (km)
  ISTMAX - INTEGER Variable (Input) - Dimension of IZLSH and DRZLSH
  SRCEV  - REAL Variable (Output) - Elevation angle of source at the
             background (deg)
  IAZREF - INTEGER Variable (Input) - Azimuth reference index
  SOLAZ  - REAL Variable (Input) - Solar azimuth (deg)
  SOLFAC - REAL Array (Dim = MAXLAT x MAXLON x Unspecified) (Output) -
             Proportionality factor for the ray
  IBKGD  - INTEGER Variable (Input) - Background index
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Switch for model atmospheres
  NSOLFC - INTEGER Array (Dim = 2 x Unspecified) (Input/Output) -
             Array limits for non-zero values of SOLFAC
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,ISMX,MAXLAT,MAXLON,NGMAX,NL,MOLMAX
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15, NL=50)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         COS,SIN,REAL,DBLE,SQRT,ACOS,ASIN,MAX,MIN
      EXTERNAL          RAYPTH,HOREQU,SPTRIG,INTR2D,ATMSBD
```

Local Variable Declarations:

```
      INTEGER           I,L1,L2,LT,LTM,MLP,ISRC,LENS,ITDUM(MLMX2),KK,LL
      REAL              R(MLMX2),PHI(MLMX2),THETA(MLMX2),ALPHA,DELTA,
                          XLOS(3),AZP,PTHLAT,PTHLON,BETA,HTNGT
      DOUBLE PRECISION  SOLE,DRX,RX,SNSEL,CSSCAT,DSC
```

COMMON Blocks: /ATMDAT/,/CONSTN/,/INITAL/

SUBROUTINE SKYNOI

Argument Declarations:

```
  Z       - REAL Variable (Input) - Altitude (km)
  P       - REAL Variable (Input) - Pressure at Z (mb)
  T       - REAL Variable (Input) - Temperature at Z (K)
  CMOL    - REAL Vector (Len = Unspecified) (Input) - Molecular concentrations
              at Z (ppm)
  ZM      - REAL Variable (Input) - Altitude just below Z (km)
  PM      - REAL Variable (Input) - Pressure at ZM (mb)
  TM      - REAL Variable (Input) - Temperature at ZM (K)
  CMOLM   - REAL Vector (Len = Unspecified) (Input) - Molecular concentrations
              at ZM (ppm)
  ZP      - REAL Variable (Input) - Altitude just above Z (km)
  PP      - REAL Variable (Input) - Pressure at ZP (mb)
  TP      - REAL Variable (Input) - Temperature at ZP (K)
  CMOLP   - REAL Vector (Len = Unspecified) (Input) - Molecular concentrations
              at ZP (ppm)
  CN2     - REAL Variable (Input) - Refractivity structure constant (m^-2/3)
  CT2     - REAL Variable (Output) - Temperature structure constant (K^2/m^2/3)
  CSM2    - REAL Variable (Output) - Molecular scatter structure constant
              divided by the molecular scatter coefficient squared (m^-2/3)
  CSA2    - REAL Variable (Output) - Aerosol scatter structure constant
              divided by the aerosol scatter coefficient squared (m^-2/3)
  XL0     - REAL Variable (Output) - Turbulence scale length (m)
  SKYFAC  - REAL Vector (Len = Unspecified) (Output) - Factor used in
              evaluating sky noise
                1 - Thermal sky noise
                2 - Molecular scatter
                3 - Aerosol scatter
  HB      - REAL Variable (Input) - Terrain altitude (km)
```

INTRINSIC and EXTERNAL Declarations:

```
      DOUBLE PRECISION REFRAC
      INTRINSIC        MAX,ABS,LOG,SQRT,REAL
      EXTERNAL         REFRAC
```

Local Variable Declarations:

```
      INTEGER          K
      REAL             DNDT,DNDP,DZ,DZ1,DZ2,DTDZ,DPDZ,DQDZ,DNDQDZ,
                         DNDHDZ,DNDQ(3),DT,DSMDN,DSADN
      DOUBLE PRECISION AN,XN1,XN2
```

COMMON Blocks: /CONSTN/

REAL FUNCTION SLPOS

Argument Declarations:

```
  XLAT0  - REAL Variable - Reference latitude (in degrees and fractions
             of degrees,   is north)
  XLON0  - REAL Variable - Reference longitude (in degrees and fractions
             of degrees,   is east)
  XLAT   - REAL Variable - Latitude (in degrees and fractions of
             degrees,   is north)
  XLON   - REAL Variable - Longitude (in degrees and fractions of
             degrees,   is east)
  SOLEV  - REAL Variable - Default (geometric) value of solar elevation (deg)
  LBKGD  - INTEGER Variable - Background altitude index
  LSOLAR - INTEGER Variable - Solar/lunar altitude index
  NLAT   - INTEGER Variable - Number of latitudes
  NLON   - INTEGER Variable - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER          MLMAX,MLMX2
      PARAMETER        (MLMAX=140, MLMX2=2*MLMAX)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        COS,ACOS,SIN,REAL,DBLE
      EXTERNAL         HORIZN,GEOM
```

Local Variable Declarations:

```
      INTEGER          IZ(MLMX2),LENP,IBKGD,IERR,KL,ITPGM,IPRINT,
                         LBKGD0,LSOLR0,MLAT,MLON
      REAL             SRRS,BETAS,PHI1,PHI2,SRMAX,BETMAX,RHOS,BHOS,
                         PHOS,R(MLMX2),PHI(MLMX2),THETA(MLMX2),
                         HTNGT,HSEND
```

COMMON Blocks: /CONSTN/

REAL FUNCTION SLRCNT

Argument Declarations:

```
  SOLDIS - REAL Variable - Normalized solar distance
```

INTRINSIC and EXTERNAL Declarations:

```
CXX   REAL             SOLAR
CXX   INTRINSIC        REAL,DPROD
CXX   EXTERNAL         SOLAR
      EXTERNAL         SOLRBD
```

Local Variable Declarations:

```
CXX   INTEGER          I
      REAL             V,DV,DUM
CXX   DOUBLE PRECISION SUM
```

COMMON Blocks: /SOLIR1/

REAL FUNCTION SLUNAR

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  DV     - REAL Variable - Wavenumber increment (cm-1)
  PHLUNR - REAL Variable - Phase of the moon (deg)
  SOLDIS - REAL Variable - Normalized solar distance
             SOLDIS = 1.0 implies a solar constant of 1353 W/m2
  XLUNDS - REAL Variable - Normalized lunar distance
```

PARAMETER Declarations:

```
      INTEGER          NEL,NALB
      PARAMETER        (NALB=30, NEL=37)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP,SOLAR
      INTRINSIC        COS,SIN
      EXTERNAL         XTERP,SOLAR
```

Local Variable Declarations:

```
      INTEGER          ITRP0
      REAL             ALBED(NALB),WLL(NALB),CORREC(NEL),ELONG(NEL),
                         THETA,SPHERE,ERTHMN,RMOON,WL
```

COMMON Blocks: /CONSTN/

SUBROUTINE SMPCAL

Argument Declarations:

ML - INTEGER Variable (Input) - Number of lines-of-sight
MLMX2 - INTEGER Variable (Input) - Maximum DIMENSION of several arrays
NL - INTEGER Vector (Len = Unspecified) (Input) - Number of altitude layers for each line-of-sight
ITL - INTEGER Array (Dim = MLMX2 x Unspecified) (Input) - Altitude index of each path
DRL - REAL Array (Dim = MLMX2 x Unspecified) (Input) - Path increments of each path length (km)
SOLFAC - REAL Array (Dim = MAXLAT x MAXLON x MLMX2 x Unspecified) (Input) - Proportionality factor for multiple atmospheres
NSOLFC - INTEGER Array (Dim = 2 x 2 x Unspecified) (Input) - Limits for the non-zero elements of SOLFAC
RADINT - REAL Variable (Input) - Initial (exoatmospheric) irradiance ($W/cm^2/cm^{-1}$)
RADSMP - REAL Vector (Len = Unspecified) (Output) - Irradiance at the various altitudes ($W/cm^2/cm^{-1}$)
DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,MAXLAT,MAXLON,MOLMAX
      PARAMETER         (MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL
      EXTERNAL          PTHTAU
```

Local Variable Declarations:

```
      INTEGER           K,L,KL,ITYPE,ISTORE,MM1
      REAL              S1(ISMX),S2(ISMX),S3(ISMX),S4(ISMX),S5(ISMX),
                          S6(ISMX),TAUX
      DOUBLE PRECISION XS(ISMX),TAUL(MLMAX),TAULA(MLMAX)
      LOGICAL           FLTRN
```

COMMON Blocks: None

REAL FUNCTION SNOWEX

Argument Declarations:

```
  SRATE  - REAL Variable - Snow rate, expressed in terms of water content
             (mm/hr)
  TEMP   - REAL Variable - Temperature (K)
  ITYPE  - INTEGER Variable - Type of snow
             ITYPE = 0 implies no snow
             ITYPE = 1 implies needle crystals
             ITYPE = 2 implies plain dendritic crystals
             ITYPE = 3 implies spatial dendritic crystals
             ITYPE = 4 implies powder snow
             ITYPE = 5 implies crystal with droplet
             ITYPE = 6 implies graupel
```

PARAMETER Declarations:

```
      INTEGER          NBIN
      PARAMETER        (NBIN=21)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX,MIN,INT,REAL,SQRT,ABS,EXP
      EXTERNAL         SNOWBD
```

Local Variable Declarations:

```
      INTEGER          I,ITMP,ITMP1,ICRYS
      REAL             XTMP,FACTMP,RHOW,QEXT,DUM,R32,DREFF,R,DCRYS,
                         VOL,AREA,ARTOT,VOLTOT,RC,ALPHA,GAMMA,FRAD,VEL
```

COMMON Blocks: /CONSTN/,/SNWDAT/

SUBROUTINE SNOWSP

Argument Declarations:

```
  WL     - REAL Variable (Input) - Wavelength (μm)
  TEMP   - REAL Variable (Input) - Temperature (K)
  ISNOW  - INTEGER Variable (Input) - Snow index
  SNABS  - REAL Variable (Output) - Normalized absorption coefficient
  SNSCT  - REAL Variable (Output) - Normalized scattering coefficient
```

PARAMETER Declarations:

```
      INTEGER          NWLCLD
      PARAMETER        (NWLCLD=79)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MIN
      EXTERNAL         PROFAC,RAINBD
```

Local Variable Declarations:

```
      INTEGER          KEYWL,KEYWLP,KTP,KTPP
      REAL             FACWL,DUM1,DUM2,FACTP
```

COMMON Blocks: /RAINWL/

SUBROUTINE SOIL

Argument Declarations:

```
  WATER  - COMPLEX Variable (Input) - Dielectric constant of water
  ICE    - COMPLEX Variable (Input) - Dielectric constant of ice
  MV     - REAL Variable (Input) - Volumetric moisture in vegetation
  EM     - COMPLEX Variable (Output) - Mean dielectric constant of soil
  DEL    - REAL Variable (Output) - Standard deviation of the dielectric
           constant of soil
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS,CMPLX
      EXTERNAL          EMISBD
```

Local Variable Declarations:

```
      REAL              WP,GAM,WT,SAND,CLAY,P
      COMPLEX           EX,AIR,ROCK
```

COMMON Blocks: None

REAL FUNCTION SOLAR

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  DV     - REAL Variable - Wavenumber increment over which irradiance is
           averaged (cm-1)
  SOLDIS - REAL Variable - Solar distance (in terms of mean distance)
```

INTRINSIC and EXTERNAL Declarations:

```
      LOGICAL           EVEN
      INTRINSIC         REAL,INT,MOD
      EXTERNAL          SLR1BD,SLR2BD,SLR3BD,SLR4BD,SLR5BD,EVEN
```

Local Variable Declarations:

```
      INTEGER           I,IV,IDV,IP
      REAL              P,WL0,V0,VP,WT,DVREF
      LOGICAL           EVN
```

```
COMMON Blocks:          /SOLIR1/,/SOLIR2/,/SOLIR3/,/SOLIR4/,/SOLIR5/
```

SUBROUTINE SOLBND

Argument Declarations:

Z	- REAL Vector (Len = Unspecified) (Input) - Altitude (m) vs. pressure (10 mb increment) array
FUO	- REAL Variable (Input) - Exo-atmospheric solar flux times UO
UO	- REAL Variable (Input) - Cosine of solar zenith angle
UD	- REAL Vector (Len = Unspecified) (Output) - Upward diffuse shortwave flux (W/m^2) at each layer boundary
DD	- REAL Vector (Len = Unspecified) (Output) - Downward diffuse shortwave flux (W/m^2) at each layer boundary
SD	- REAL Vector (Len = Unspecified) (Output) - Downward beam shortwave flux (W/m^2) at each layer boundary
ALBS	- REAL Variable (Input) - Solar band diffuse reflectance
CLDP	- REAL Vector (Len = Unspecified) (Input) - Cloud cover (%) 1 - Low etage 2 - Middle etage 3 - High etage

INTRINSIC and EXTERNAL Declarations:

```
      REAL              BBO3
      INTRINSIC         ABS,SQRT,EXP
      EXTERNAL          BBO3,BRBNBD,SRAT,CLDLYR,SRTLAY,SPROD,SWAT
```

Local Variable Declarations:

```
      INTEGER           I,J,IB,IK
      REAL              R(9),T(9),US(9),DS(9),X(9),S(9),TRY(9),
                          AMAG(9),UP(9),UDB(10),DDB(10),SDB(10),G0,
                          UOO,UOT,SO,B,BU,CLA,OMC,TAU,G,TAUB,WO,WOB,TT,
                          TC,TCB,WC,WCB,DCL,RCL,TCL,UCL,A,DTCB,DTUB,TS
```

COMMON Blocks: /INITL/,/OMATLW/,/SWPARM/

SUBROUTINE SOLRAD

Argument Declarations:

TAUL - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Transmittances at each point along path (i.e., an incremental set of transmittance)
L - INTEGER Variable (Input) - Layer index at which calculations are to be made
KL - INTEGER Variable (Input) - Altitude index at which calculations are to be made
SOLXM - REAL Variable (Output) - Apparent solar irradiance as a function of azimuth ($W/cm^2/cm^{-1}$)
RDSOLR - REAL Variable (Input/Output) - Running integral along path of scattered solar and lunar radiation ($W/cm^2/cm^{-1}$)
RDSVAR - REAL Variable (Input/Output) - Running integral along path of variance scattered solar and lunar radiation ($(W/cm^2/cm^{-1})^2$)
XS - DOUBLE PRECISION Vector (Len = Unspecified) (Input/Output) - Optical depth
S1 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for Lorentz halfwidth times line density
S2 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for Doppler halfwidth times line density
S3 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for line density
S4 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for the continuum
S5 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for scattering
S6 - REAL Vector (Len = Unspecified) (Input/Output) - Summing variable for $(\text{Lorentz halfwidth})^2$ times line density
ANGLE - REAL Vector (Len = Unspecified) (Input) - Array of scattering angles (deg)
SCATTR - REAL Array (Dim = NANG x MAXLAT x Unspecified) (Input) - Angle dependent scattering parameters, including the phase function and albedo (sr^{-2})
SCTVAR - REAL Array (Dim = NANG x MAXLAT x Unspecified) (Input) - Angle dependent variance of the scattering parameters, including the phase function and albedo (sr^{-2})
NANG - INTEGER Variable (Input) - First DIMENSION of ANGLE, SCATTR, and SCTVAR
SOLX - REAL Variable (Input) - Exoatmospheric spectral solar irradiance ($W/cm^2/cm^{-1}$)
NSL - INTEGER Variable (Input) - Number of layers in solar path
ISL - INTEGER Vector (Len = Unspecified) (Input) - Altitude indices for the solar paths
DRSL - REAL Vector (Len = Unspecified) (Input) - Path length increments for the paths (km)
SCTANG - REAL Variable (Input) - Solar scattering angels (deg)
SOLYR - REAL Array (DIM = MLMX2 x MAXLAT x Unspecified) (Input) - Solar irradiance at each altitude ($W/cm^2/cm^{-1}$)
NDXSL - INTEGER Variable (Input) - Index providing the starting point the ISL and DRSL arrays for the appropriate paths
FLSLR - LOGICAL Variable (Input) - Switch for solar calculations.
FLSMP - LOGICAL Variable (Input) - Switch for type of calculations.
LP - INTEGER Variable (Input/Output) - Secondary altitude index
SCT1 - DOUBLE PRECISION Variable (Input/Output) - Scattering term storage
SCT3 - DOUBLE PRECISION Variable (Input/Output) - Scattering variance storage
DRKM - REAL Variable (Input) - Incremental ranges along solar scattered path (km)
PTHFAC - REAL Array (Dim = MAXLAT x MAXLON x Unspecified) (Input) - Proportionality factor for the multiple atmospheres
NPTH - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits for non-zero elements of PTHFAC
DV - REAL Variable (Input) - Wavenumber increment (cm^{-1})

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,MAXLAT,MAXLON
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX, MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP,RADTRY
      INTRINSIC         REAL,DPROD,DBLE
      EXTERNAL          PTHTAU,XTERP,RADTRY
```

Local Variable Declarations:

```
      INTEGER           KK,LL,MM1,ITRP1,ITYPE,ISTORE
      REAL              SCTDM2,SCTDM4,TAUSLR
      DOUBLE PRECISION  TAUX(MLMX2),TAUXA(MLMX2),SCT2,SCT4,DELTAU,
                          DDRKM
      LOGICAL           FLTRN
```

COMMON Blocks: None

SUBROUTINE SPCLYR

Argument Declarations:

```
  TSRF   - REAL Variable (Input) - Initial surface temperature (K)
  TSSL   - REAL Variable (Input) - Initial sub-surface temperature (K)
  MT     - INTEGER Variable (Input) - Material index
  TLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) -
             Temperatures in conducting subsurface (K)
  ZLAYER - REAL Vector (Len = 0:Unspecified) (Input/Output) - Layer depth (m)
  NLAYER - INTEGER Variable (Input) - Number of layers
  SPHLYR - REAL Vector (Len = 0:Unspecified) (Output) - Specific heat
             at each layer (W-sec/gm/K)
  DENLYR - REAL Vector (Len = 0:Unspecified) (Output) - Density
             at each layer (gm/m^3)
  HTCLYR - REAL Vector (Len = 0:Unspecified) (Output) - Conductance
             coefficient at each layer (W/m^2/K)
  FLINI  - LOGICAL Variable (Input) - Initialization flag
  PRESS  - REAL Variable (Input) - Atmospheric pressure (mb)
  CMOL   - REAL Vector (Len = 0:Unspecified) (Input) - Atmospheric
             molecular concentrations (ppmv)
```

PARAMETER Declarations:

```
      INTEGER           NMATL,MAXLAT,MAXLON
      PARAMETER         (NMATL=28, MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              THCICE,THCSNW,SPHICE,DENWTR,THCWTR,SPHWTR,
                          DENAIR,THCAIR,SPHAIR
      INTRINSIC         MAX,MIN,SQRT,EXP,REAL,COS
      EXTERNAL          THCICE,THCSNW,SPHICE,DENWTR,THCWTR,SPHWTR,
                          BKGDBD,DENAIR,THCAIR,SPHAIR
```

Local Variable Declarations:

```
      INTEGER           K,L
      REAL              PERIOD,DAMPD,DZ
```

COMMON Blocks: /BACKGD/

REAL FUNCTION SPHAIR

Argument Declarations:

```
  CH2O   - REAL Variable - Water vapor content (ppmV)
```

INTRINSIC and EXTERNAL Declarations: None

Local Variable Declarations: None

COMMON Blocks: None

REAL FUNCTION SPHICE

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

PARAMETER Declarations:

```
      INTEGER           NSPH
      PARAMETER         (NSPH=11)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           ITRP0
      REAL              T(NSPH),SPH(NSPH),TC
```

COMMON Blocks: None

REAL FUNCTION SPHWTR

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

PARAMETER Declarations:

```
      INTEGER           NSPH
      PARAMETER         (NSPH=19)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           ITRP0
      REAL              T(NSPH),SPH(NSPH),TC
```

COMMON Blocks: None

SUBROUTINE SPROD

Argument Declarations:

SO	- REAL Variable (Input)	- Incident solar flux times cosine zenith angle (W/m^2)
UO	- REAL Variable (Input)	- Cosine zenith angle
TAU	- REAL Variable (Input)	- Optical depth
W	- REAL Variable (Input)	- Single scattering albedo
B	- REAL Variable (Input)	- Hemisphere average backscattering fraction
BU	- REAL Variable (Input)	- Zenith angle dependent backscattering fraction
R	- REAL Variable (Input)	- Diffuse reflection coefficient
T	- REAL Variable (Input)	- Diffuse transmission coefficient
U	- REAL Variable (Output)	- Upward diffuse flux (W/m^2) scattered from the solar beam
D	- REAL Variable (Output)	- Downward diffuse flux (W/m^2) scattered from the solar beam
CLA	- REAL Variable (Input)	- Cloud fraction

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,EXP,DBLE,DPROD
```

Local Variable Declarations:

```
      DOUBLE PRECISION DWM,A,E,G,DD,SS
```

COMMON Blocks: None

SUBROUTINE SPTRIG

Argument Declarations:

XLAT	- REAL Variable (Output)	- Final latitude (deg.)
XLON	- REAL Variable (Output)	- Final longitude (deg.)
XLAT0	- REAL Variable (Input)	- Initial latitude (deg.)
XLON0	- REAL Variable (Input)	- Initial longitude (deg.)
AZIM	- REAL Variable (Input)	- Azimuth of angular distance measured at initial point. 0.0 implies North, 90.0 implies East. (deg.)
BETA	- REAL Variable (Input)	- Angular extent of distance measured from the center of the earth (deg)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,ATAN2,ASIN,SIN,COS,ACOS,DBLE
```

Local Variable Declarations:

```
      DOUBLE PRECISION DUMX,DUMY,AZIMP,DLON,DBETA
```

COMMON Blocks: /CONSTN/

SUBROUTINE SRAT

Argument Declarations:

```
  UO     - REAL Variable (Input) - Cosine of plane parallel solar zenith angle
  I      - INTEGER Variable (Input) - Index of layer (1 - top to 9 - bottom)
  Z      - REAL Vector (Len = Unspecified) (Input) - Array of
             altitudes (m) vs. pressure (10 mb)
  UP     - REAL Variable (Output) - Modified cosine of solar zenith
             angle for a spherical geometry
  UOT    - REAL Variable (Output) - Modified cosine of solar zenith
             angle at the next layer for a spherical correction
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          SIN,COS,ASIN,ACOS,SQRT,REAL,DBLE,ABS
```

Local Variable Declarations:

```
      REAL               RZ,DZ
      DOUBLE PRECISION TO,TP,RE,R,RDZ
```

COMMON Blocks: /CLIMAT/

SUBROUTINE SRCFLX

Argument Declarations:

```
  PTHFAC - REAL Array (Dim = MXLAT x MXLON x MLMX2 x Unspecified) -
             Proportionality factor at source
  NPTH   - INTEGER Array (Dim = 2 x 2 x Unspecified) - Limits of non-zero
             values of PTHFAC
  MXLAT  - INTEGER Variable (Input) - Maximum number of latitudes
  MXLON  - INTEGER Variable (Input) - Maximum number of longitudes
  MLMX2  - INTEGER Variable (Input) - Maximum number of path segments
  NSRC   - INTEGER Variable (Input) - Source index for path segments
  IGEOM  - INTEGER Variable (Input) - Geometry number
  MTIME  - INTEGER Variable (Input) - Number of temporal values
```

PARAMETER Declarations:

```
      INTEGER            NGMAX,NAZMAX,NASMAX,NZSMAX,NTIME,MAXLAT,MAXLON,
                           NVSMAX,ISMX,MOLMAX
      PARAMETER          (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER          (NTIME=97)
      PARAMETER          (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER          (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC          REAL,INT
```

Local Variable Declarations:

```
      INTEGER            L,LEVD,LEVU,IT,ITM,MM,KK,LL
      REAL               FAC,FACT
```

COMMON Blocks: /BRBNDT/,/HEADER/

SUBROUTINE SRCGEO

Argument Declarations:

```
  NSRC   - INTEGER Vector (Len = Unspecified) (Output) - Number of points in
             altitude-source path
  ITSRC  - INTEGER Array (Len = MLMX2 x Unspecified) (Output) - Index of
             altitude grid points for background-source path for simple
             calculations
  DRSRC  - REAL Array (Len = MLMX2 x Unspecified) (Output) - Path length
             segments for background-source path for simple calculations (km)
  PHIL   - REAL Variable (Output) - Elevation angles along simple path (deg)
  LSRC   - INTEGER Variable (Input) - Source altitude index
  XLAT   - REAL Variable (Input) - Latitude (deg)
  XLON   - REAL Variable (Input) - Longitude (deg)
  SOLFAC - REAL Array (Dim = MAXLAT x MAXLON x MLMX2 x Unspecified) (Output) -
             Proportionality factor for background-source path for simple
             calculations
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Switch for model atmospheres
  NSOLFC - INTEGER Array (Dim = 2 x 2 x Unspecified) (Input/Output) -
             Array limits for non-zero values of SOLFAC
  XLATSR - REAL Variable (Input) - Source latitude (deg)
  XLONSR - REAL Variable (Input) - Source longitude (deg)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,NAZMAX,ISMX,MAXLAT,MAXLON,NGMAX,NL,
                          MOLMAX
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX, NAZMAX=30)
      PARAMETER         (MAXLAT=3, MAXLON=1, NGMAX=15, NL=50)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,COS,SIN,MAX,MIN,DBLE
      EXTERNAL          GEOM,SPTRIG,INTR2D,ATMSBD,HORIZN
```

Local Variable Declarations:

```
      INTEGER           ITDUM(MLMX2),LS,LSX,LSP,L1,L2,L,ISRC,LENS,MM,
                          KL,KK,LL
      REAL              R(MLMX2),PHI(MLMX2),THETA(MLMX2),HMIN,BETA,AZP,
                          XLATP,XLONP,ELEV,PTHLAT,PTHLON,DTDPAV,SOLAZP
      DOUBLE PRECISION  SOLE,SRC(3),SCTPT(3)
```

COMMON Blocks: /ATMDAT/,/CONSTN/,/INITAL/

SUBROUTINE SRCIRR

Argument Declarations:

```
  IFSCR  - INTEGER Variable (Input/Output) - File number for scratch
             file for solar path data
               If IFSCR = 0, file is not OPENed.
  ISHINE - INTEGER Variable (Input) - Sky/earthshine index
             Refer to User Reference Manual for definition.
  IGEOM  - INTEGER Variable (Input) - Geometry index
  ISWATM - INTEGER Array (Dim = MAXLAT x Unspecified) (Input/Output) -
             Switch for model atmospheres
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,MLMX2,ISMX,ISTMAX,NAZMAX,NASMAX,NGMAX,
                          NZSMAX,MAXLAT,MAXLON,NVSMAX,NL,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MLMX2=2*MLMAX)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (ISTMAX=30000)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20, NL=50)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         MAX,SIN,COS,MIN,DBLE
      EXTERNAL          RAYPTH,CALEND,HOREQU,EQUECL,ECLGAL,SETUP,IOERR,
                          ASPECT,SHNGEO,INDXBK,SPTRIG,HORIZN,INTR2D,
                          ATMSBD
```

Local Variable Declarations:

```
      INTEGER           I,L,L1,LM,LSH,M,MM,IDAYX,LENS,KK,LL,IOS,KL,IERR
      REAL              R(MLMX2),THETA(MLMX2),ELEV,BETA,DYEAR,XLEQUT,
                          BEQUT,PHIHOR,THD,XLATP,XLONP,TAIRP,
                          CLDCVP(0:3),TMIDN,TNOON,AZP,SOLAZP,SRMAX,
                          BETMAX,RHRT,BHRT,HTNGT
      DOUBLE PRECISION  PHISHR,SOL(3),XLN(3),SCTPT(3)
```

```
COMMON Blocks:          /ATMDAT/,/CONSTN/,/FLAGS/ ,/HEADER/,/INITAL/,
                          /PATH2/,/PATH2A/,/PATH2B/,/PATH2C/,/PATH2D/,
                          /PATH4/
```

SUBROUTINE SRFLUX

Argument Declarations:

```
  RFDS   - REAL Variable (Input) - Direct solar flux (W/m²)
  DSW    - REAL Variable (Input) - Downward short-wave flux (W/m²)
  DLW    - REAL Variable (Input) - Downward long-wave flux (W/m²)
  ABSSLR - REAL Variable (Input) - Solar absorptivity
  EMSTRM - REAL Variable (Input) - Thermal emissivity
  HTCOND - REAL Variable (Input) - Conductance coefficient (W/m²/K)
  CHARLN - REAL Variable (Input) - Surface characteristic length (m)
  TAIR   - REAL Variable (Input) - Air temperature (K)
  PRESS  - REAL Variable (Input) - Air pressure (mb)
  WINDT  - REAL Variable (Input) - Wind speed (m/sec)
  TLAYER - REAL Vector (Len = 0:Unspecified) (Input) - Temperatures in each
             layer (K)
  ZLAYER - REAL Vector (Len = 0:Unspecified) (Input) - Layer depth (m)
  H      - REAL Variable (Input) - Effective depth of heat storage (m)
  IHTFLG - INTEGER Variable (Input) - Heat calculation index
             IHTFLG = 0 implies no heat calculations
             IHTFLG = 1 implies heat calculations with evaporation
             IHTFLG = 2 implies heat calculations without evaporation
  A      - REAL Variable (Output) - Coefficient for the T⁴ term
  B      - REAL Variable (Output) - Coefficient for the T term
  C      - REAL Variable (Output) - Coefficient for the constant term
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              EVAPOR,SATUR
      INTRINSIC         ABS
      EXTERNAL          EVAPOR,SATUR
```

Local Variable Declarations:

```
      INTEGER           ITYPE
      REAL              SIGMA,CP,GAM,REC,P0,WAIR,WH2O,RATIO,
                          TREF,XMU,DENS,T0,HCFORC,HCFREE,
                          RLATEN,FLUXD,FLUXU,DT
CXX   REAL              FLUXD,FLUXU,RI,RO,RCONV,R2TDZ2,DTDZ1,DTDZ2
```

COMMON Blocks: None

SUBROUTINE SRTLAY

Argument Declarations:

R	- REAL Variable (Output) - Spherical reflection coefficient
T	- REAL Variable (Output) - Spherical transmission coefficient
G	- REAL Variable (Input) - Asymmetry factor
W	- REAL Variable (Input) - Scattering albedo
TAU	- REAL Variable (Input) - Layer optical depth
RE	- DOUBLE PRECISION Variable (Input) - Radius of the earth (km)
ZM	- REAL Variable (Input) - Prior altitude (km)
Z	- REAL Variable (Input) - Altitude of interest (km)
ZP	- REAL Variable (Input) - Next altitude (km)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              BETAU
      INTRINSIC         REAL
      EXTERNAL          DRTLAY,BETAU,GETGLC
```

Local Variable Declarations:

```
      INTEGER           I,N,INDX
      REAL              BU,RMU,RWT,RU,TU
      DOUBLE PRECISION XMU(12),WT(12)
```

COMMON Blocks: /CONSTN/

REAL FUNCTION STARAD

Argument Declarations:

XL	- REAL Variable - Galactic azimuth (deg)
B	- REAL Variable - Galactic elevation (deg)
V	- REAL Variable - Wavenumber (cm^{-1})
DV	- REAL Variable - Wavenumber increment (cm^{-1})

INTRINSIC and EXTERNAL Declarations:

```
      REAL              PLANCK
      INTRINSIC         EXP,ABS
      EXTERNAL          PLANCK
```

Local Variable Declarations:

```
      INTEGER           I
      REAL              C0,C(2,4),CP(2),T0,AL,PHI
```

COMMON Blocks: /CONSTN/

SUBROUTINE STGEOM

Argument Declarations:

```
  STRING - CHARACTER*(*) Variable - Character string
  HOBS   - REAL Variable (Output) - Observer altitude (km)
  HSRC   - REAL Variable (Output) - Source altitude (km)
  SLRNG  - REAL Variable (Output) - Slant range (km)
  BETA   - REAL Variable (Output) - Earth center angle (deg)
  PHIOBS - REAL Variable (Output) - Observer look angle (deg)
  PHISRC - REAL Variable (Output) - Source look angle (deg)
  LENP   - INTEGER Variable (Output) - Length switch
             0 - Short path
             1 - Long path
  VRDATA - CHARACTER*(*) Vector (Len = Unspecified) (Input) - Values to be
             read in.
  ITPGM  - INTEGER Variable (Output) - Calculation type
             0 - At-Source
             1 - S/B/C: Slant Range
             2 - S/B/C: Earth Center angle
             3 - S/B/C: Source Look Angle  or L: Tangent Height
             4 - S/B/C/L: Observer Look Angle
             5 - S/B/C: Observer Look Angle with Slant Range
             6 - S/B/C: Observer Look Angle with Earth Center Angle
             7 - Horizontal: Range
             8 - Horizontal: Earth Center Angle
             9 - Limb: Tangent Latitude/Longitude
  IGMSW  - INTEGER Variable (Output) - Geometry label index
             1 - At-Source
             2 - Source (only)
             3 - Background (only)
             4 - Contrast (source and background)
             5 - Limb path
             6 - Horizontal path
  IANGSW - INTEGER Variable (Output) - Angle label index
             1 - Elevation angle
             2 - Zenith angle
             3 - Latitude and longitude
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          IGTINT
      REAL             GETVAR
      CHARACTER*1      UPCASE,LWCASE
      INTRINSIC        ABS,REAL,DBLE
      EXTERNAL         GETVAR,IGTINT,UPCASE,LWCASE
```

Local Variable Declarations:

```
      REAL             ALTMAX
      DOUBLE PRECISION RE
```

COMMON Blocks: /CONSTN/

REAL FUNCTION STRCN2

Argument Declarations:

```
  Z       - REAL Variable - Altitude (km)
  HB      - REAL Variable - Terrain altitude (km)
  HTRPAU  - REAL Variable - Tropopause altitude (km)
  CN2SRF  - REAL Variable - Surface value of Cn^2 (m^-2/3)
  WINDHI  - REAL Variable - Average windspeed (m/sec)
  PRESS   - REAL Variable - Pressure (mb)
  TEMP    - REAL Variable - Temperature (K)
  WH2O    - REAL Variable - Water vapor concentration (ppm)
  WCO2    - REAL Variable - Carbon dioxide concentration (ppm)
  WO2     - REAL Variable - Oxygen concentration (ppm)
  WL      - REAL Variable - Wavelength (μm)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NASMAX,ISMX,MOLMAX
      PARAMETER         (MLMAX=140, NASMAX=15)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      DOUBLE PRECISION  REFRAC
      INTRINSIC         ABS,EXP,REAL
      EXTERNAL          XTERP,REFRAC
```

Local Variable Declarations:

```
      INTEGER           ITRP1
      REAL              WL0,ALT,ZP,ZTRPAU,ZINF,FAC,AVALLY,VV0,CN2BCK,
                          WND,CN2X55,P1,T1,W1
      DOUBLE PRECISION  DN0XP,DN0XT,DN0XW1,XNOPT,XNWL,DNDN0,REARTH
```

COMMON Blocks: /CONSTN/,/USERDF/

SUBROUTINE SUMFIL

Argument Declarations:

```
  FILERT - CHARACTER*(*) Variable (Input) - File root name or file name
  HEADNG - CHARACTER*(*) Variable (Input) - Heading
  TITLE  - CHARACTER*(*) Variable (Input) - Title
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX,MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           LENSTR
      CHARACTER*72      IOERR
      INTRINSIC         INT,ABS,MAX,MIN,LEN,REAL
      EXTERNAL          CHRCBD,DEVCBD,PUTCLD,PUTSLR,CHTIME,LENSTR,IOERR
```

Local Variable Declarations:

```
      INTEGER           I,K,LSTR,IHR,IMN,IOS,KA,KK,LL,ISEC,ITYP0
      REAL              YLAT,YLONG,SEC,XSEC,PH1,PH2
      LOGICAL           FLUSR
      CHARACTER*1       GMTYPE(6),ANTYPE(3)
      CHARACTER*3       TTIME(2),MONTH(12)
      CHARACTER*4       LONG
      CHARACTER*5       LAT
```

COMMON Blocks: /CHRCNM/,/DEVCNM/,/DEVICE/,/FLAGS/,/HEADER/, /MOLECP/,/USERNM/

REAL FUNCTION SUPK

Argument Declarations:

```
  V      - REAL Variable - Wavenumber (cm-1)
  V0     - REAL Variable - Center wavenumber (cm-1)
  C      - REAL Variable -
  N      - INTEGER Variable -
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS
```

Local Variable Declarations:

```
      REAL              XNORM,VM,X,TEN,XX,CXI
```

COMMON Blocks: /CONSTN/

SUBROUTINE SWAT

Argument Declarations:

```
  RO      - REAL Vector (Len = Unspecified) (Input) - Layer reflection
              functions
  TO      - REAL Vector (Len = Unspecified) (Input) - Layer transmission
              functions
  US      - REAL Vector (Len = Unspecified) (Input) - Layer up diff
              fluxes from solar beam
  DS      - REAL Vector (Len = Unspecified) (Input) - Layer down diff
              fluxes from solar beam
  S       - REAL Vector (Len = Unspecified) (Input) - Depleted solar
              beam fluxes at layer boundaries
  AB      - REAL Variable (Input) - Solar band ground diffuse reflectance
  UD      - REAL Vector (Len = Unspecified) (Output) - Upward diffuse
              solar band fluxes at layer boundaries
  DD      - REAL Vector (Len = Unspecified) (Output) - Downward diffuse
              solar band fluxes at layer boundaries
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GAM,RAB,RBE,DDIF,UDIF
      EXTERNAL          GAM,RAB,RBE,DDIF,UDIF
```

Local Variable Declarations:

```
      REAL              RA,RB,RC,RAS,RBS,RCS,TA,TB,TC,G,GA,GB,GC,
                          RR1,RR2,R1,R2,RS,RS1,RS2,TT,US1,US2,DS1,DS2,
                          DAS,DBS,DCS,DTS,UAS,UBS,UCS,UTS,DSA,DSB,
                          USA,USB,RRS1,RRS2
```

COMMON Blocks: None

SUBROUTINE TANGPT

Argument Declarations:

```
  R       - REAL Vector (Len = Unspecified) (Input/Output) - Array of
              slant ranges along the ray (km)
  PHI     - REAL Vector (Len = Unspecified) (Input/Output) - Array of
              elevation angles along the ray (rad)
  THETA   - REAL Vector (Len = Unspecified) (Input/Output) - Array of
              earth center angles along the ray (rad)
  IZ      - INTEGER Vector (Len = Unspecified) (Input/Output) - Array
              of altitude indices along the ray
  KL      - INTEGER Variable (Input/Output) - Number of data points
              along the ray
  HTNGT   - REAL Variable (Input/Output) - Tangent altitude (km)
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,ISMX,NNNMAX,NAZMAX,NASMAX,NGAS,NGMAX,
                          NZSMAX,MAXLAT,MAXLON,NVSMAX,NVSA,MOLMAX,
                          MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NNNMAX=5, NGAS=6)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20, NVSA=9)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           ISTAER
      REAL              STRCN2,XTERP,HAZE
      INTRINSIC         REAL,DBLE,MAX,MIN,COS,SQRT,ABS
      EXTERNAL          STRCN2,XTERP,EQABS,ISTAER,MOLPBD,AERSOL,HYDROM,
                          HAZE,CLDRBD
```

Local Variable Declarations:

```
      INTEGER           I,L,LMN,IZL,IZLP,MLP,ITRPAU(MAXLAT,MAXLON),KK,
                          LL,ISTPAU(MAXLAT,MAXLON),KLAT,KLON,IPRINT,
                          ITRP0,MLX
      REAL              WL,PHI1,PHI2,XMHMIN,DELXMH,FAC,VISX,VI,VF,DUM,
                          TAV,FACICE,FACSNW,ZLP
      DOUBLE PRECISION  MH,SNELL
      LOGICAL           DUPLIC
```

```
COMMON Blocks:          /CLDRN/ ,/HEADER/,/INITAL/,/MOLCON/,/MOLECP/,
                          /PLMDAT/,/VSADTA/
```

SUBROUTINE TERMPR

Argument Declarations:

SOLEV - REAL Variable (Input) - Solar elevation (deg)
SOLAZ - REAL Variable (Input) - Solar azimuth (deg)
XLUNEV - REAL Variable (Input) - Lunar elevation (deg)
XLUNAZ - REAL Variable (Input) - Lunar azimuth (deg)
PHI - REAL Vector (Len = Unspecified) (Input) - Elevation angle background (deg)
PROJS - REAL Array (Dim = 6 x Unspecified) (Output) - Solar projection factors
SHDWS - REAL Vector (Len = Unspecified) (Output) - Self-shadowing factor for sun
PROJL - REAL Array (Dim = 6 x Unspecified) (Output) - Lunar projection factors
SHDWL - REAL Vector (Len = Unspecified) (Output) - Self-shadowing factor for moon
NPTS - INTEGER Variable (Input) - Number of points
ISCN - INTEGER Vector (Len = Unspecified) (Input) - Scene index

PARAMETER Declarations:

```
INTEGER          NGMAX,NSCEN,NMATL
PARAMETER        (NSCEN=35, NMATL=28)
PARAMETER        (NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
REAL             SHADOW
INTRINSIC        MAX,SIN,SQRT,ATAN2,ABS
EXTERNAL         SHADOW,SCENBD
```

Local Variable Declarations:

```
INTEGER          I,L,M,IBK
REAL             XNORM(6,3),XLOS(3),SLOS(3),LLOS(3),PROJ1,PROJ2,
                   AZS,AZL,SLOPE
```

COMMON Blocks: /CONSTN/,/FLAGS/,/SCENES/

REAL FUNCTION THCAIR

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations: None

Local Variable Declarations: None

COMMON Blocks: None

REAL FUNCTION THCICE

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           NT,ITRP0
      REAL              T(11),THC(11),TC
```

COMMON Blocks: None

REAL FUNCTION THCSNW

Argument Declarations:

DENSTY - REAL Variable - Density (gm/m^3)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,DBLE
```

REAL FUNCTION THCWTR

Argument Declarations:

TEMP - REAL Variable - Temperature (K)

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           ITRP0,NT
      REAL              T(11),THC(11),TC
```

COMMON Blocks: None

SUBROUTINE TITLCR

Argument Declarations:

TITLE - CHARACTER*(*) Variable (Output) - Title

INTRINSIC and EXTERNAL Declarations:

	CHARACTER*24	FDATE
CVAX	INTRINSIC	TIME,DATE
CIBM	INTRINSIC	REAL
CRS6	INTRINSIC	TIME,LOCALTIME
CF90	INTRINSIC	TIME_AND_DATE
	EXTERNAL	FDATE
CPRI	EXTERNAL	TIME$A,DATE$A
CCDC	EXTERNAL	TIME,DATE
CIBM	EXTERNAL	DATIMX
CRS6	EXTERNAL	ADDARR
CLAH	EXTERNAL	TIME,DATE

Local Variable Declarations:

CIBM	INTEGER	NOW(14)
CRS6	INTEGER	SNCEPH,TMADDR,TM(9)
CIBM	REAL	SEC
CIBM	CHARACTER*3	DAY(7),MONTH(12)
CPRI	CHARACTER*8	BUFTP
CVAX	CHARACTER*8	BUFTV
CLAH	CHARACTER*8	BUFTL
CF90	CHARACTER*8	BUFD90
CVAX	CHARACTER*9	BUFDV
CF90	CHARACTER*9	BUFT90
CCDC	CHARACTER*10	BUFTC,BUFDC
CCDC	CHARACTER*10	TIME,DATE
CLAH	CHARACTER*11	BUFDL
CPRI	CHARACTER*16	BUFDP
	CHARACTER*24	BUFDTU
CRS6	CHARACTER*24	BUFRS6
CIBM	CHARACTER*26	BUFIBM
	CHARACTER*40	BLANKS
	CHARACTER*49	MOSART

COMMON Blocks: None

CRS6 SUBROUTINE ADDARR

Argument Declarations:

ADDRSS - INTEGER Vector (Len = N) (Input) - Address locations
ARRAY - INTEGER Vector (Len = N) (Output) - Array containing address
N - INTEGER Variable (Input) - Number of addresses

Local Variable Declarations:

```
CRS6  IMPLICIT INTEGER (A-Z)
CRS6      ARRAY(I)=ADDRSS(I)
```

COMMON Blocks: None

REAL FUNCTION TMPCLD

Argument Declarations:

CLDRAD - INTEGER Variable - Cloud radiance ($\mu W/cm^2/sr$)

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        LOG
```

Local Variable Declarations:

```
      INTEGER          I
      REAL             A(8),T,R
```

COMMON Blocks: None

SUBROUTINE TRANLW

Argument Declarations:

KDX - INTEGER Variable (Input) - First index of element of matrix to be processed

JDX - INTEGER Variable (Input) - Second index of element of matrix to be processed

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        LOG10,MAX,EXP
      EXTERNAL         BRBNBD
```

Local Variable Declarations:

```
      INTEGER          I,J,M,IDXO(4),IDXT(4)
      REAL             OP(4),TOP(4),D(4),T1(4),T2(4),O1(4),O2(4),
                         EU,EV,EW,EX,OPD
```

COMMON Blocks: /FLXTAB/,/OMATLW/

SUBROUTINE TRNSMT

Argument Declarations:

TAU - DOUBLE PRECISION Variable (Output) - Transmission
TAUA - DOUBLE PRECISION Variable (Output) - Transmittance due to absorption
XS - DOUBLE PRECISION Vector (Len = Unspecified) (Input) - Optical depth
S1 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Lorentz halfwidth times line density
S2 - REAL Vector (Len = Unspecified) (Input) - Summing variable for Doppler halfwidth times line density
S3 - REAL Vector (Len = Unspecified (Input) - Summing variable for line density
S4 - REAL Vector (Len = Unspecified) (Input) - Summing variable for the continuum
S5 - REAL Vector (Len = Unspecified) (Input) - Summing variable for scattering
S6 - REAL Vector (Len = Unspecified) (Input) - Summing variable for (Lorentz halfwidth)^2 times line density
QA - REAL Vector (Len = Unspecified) (Input) - LOWTRAN exponential parameter
IBAND - INTEGER Vector (Len = Unspecified) (Input) - Band model index
ISPECS - INTEGER Variable (Input) - DIMENSION of XS, S1, S2, S3, S4, S5, S6, and QA
DV - REAL Variable (Input) - Spectral increment of transmittance calculations (cm^{-1})
FLAG - LOGICAL Variable (Input) - Flag for storing of component transmittances
MM - INTEGER Variable (Input) - Azimuth index

PARAMETER Declarations:

```
      INTEGER           ISMX,NAZMAX,MOLMAX
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, NAZMAX=30)
```

INTRINSIC and EXTERNAL Declarations:

```
      DOUBLE PRECISION BAND
      INTRINSIC        DBLE,EXP,REAL
      EXTERNAL         BAND
```

Local Variable Declarations:

```
      INTEGER          K
      DOUBLE PRECISION TAUSC,TAUP
```

COMMON Blocks: /TRANSP/

SUBROUTINE TURBUL

Argument Declarations:

NBKGD - INTEGER Variable (Input) - Number of path increments between observer and background
CN2 - REAL Array (Dim = MLMAX x MAXLAT x Unspecified) (Input) - Structure constant profile ($m^{-2/3}$)
RSCINT - REAL Vector (Len = Unspecified) (Input) - Path lengths for path between observer and background (km)
IOSB - REAL Vector (Len = Unspecified) (Input) - Altitude index for path increments between observer, source, and background in altitude array
PTHFAC - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Proportionality factor
NPTH - INTEGER Array (Dim = 2 x Unspecified) (Input) - Limits on non-zero components of PTHFAC
VARXZ - REAL Vector (Len = Unspecified) (Output) - Scintillation of points along raypath at observer
MLMAX - INTEGER Variable (Input) - Maximum number of altitude points

PARAMETER Declarations:

```
      INTEGER          MAXLAT
      PARAMETER        (MAXLAT=3)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        MAX
```

Local Variable Declarations:

```
      INTEGER          L,LB,KL,KK,LL
      REAL             XDUM,PWR,DR,CN2AV
```

COMMON Blocks: None

REAL FUNCTION UDIF

Argument Declarations:

U1 - REAL Variable - Upward flux, layer 1
U2 - REAL Variable - Upward flux, layer 2
U3 - REAL Variable - Upward flux, layer 3
D1 - REAL Variable - Downward flux, layer 1
D2 - REAL Variable - Downward flux, layer 2
R2 - REAL Variable - Diffuse reflection coefficient, layer 2
R2S - REAL Variable - Directional reflection coefficient, layer 2
R3 - REAL Variable - Diffuse reflection coefficient, layer 3
T1 - REAL Variable - Transmission, layer 1
T2 - REAL Variable - Transmission, layer 2
G - REAL Variable - Composite R and T from FUNCTION GAM

Local Variable Declarations:

```
      REAL             T,R,RR
```

COMMON Blocks: None

SUBROUTINE UDLAY

Argument Declarations:

U	- REAL Variable (Output) - Diffuse Upward reflectance
D	- REAL Variable (Output) - Diffuse Downward reflectance
ALBEDO	- REAL Variable (Input) - Single scattering albedo
EXTENC	- REAL Variable (Input) - Extinction coefficient (km^{-1})
PHI	- REAL Variable (Input) - Elevation angle at surface (deg)
B	- REAL Variable (Input) - Average backscatter fraction
BU	- REAL Variable (Input) - Backscatter fraction at PHI
RE	- DOUBLE PRECISION Variable (Input) - Radius of the earth (km)
ZM	- REAL Variable (Input) - Prior altitude (km)
Z	- REAL Variable (Input) - Altitude of interest (km)
ZP	- REAL Variable (Input) - Next altitude (km)

INTRINSIC and EXTERNAL Declarations:

INTRINSIC	MAX,EXP,SIN,ABS,REAL,DBLE,LOG,SQRT
EXTERNAL	DRTLAY

Local Variable Declarations:

REAL	XMU0,TAU,GAMMA,DELTA,SIGMA,DUM,R,T

COMMON Blocks: /CONSTN/

CHARACTER*(*) FUNCTION UPCASE

Argument Declarations:

STRING - CHARACTER*(*) Variable - Input string

INTRINSIC and EXTERNAL Declarations:

INTRINSIC	LEN,INDEX

Local Variable Declarations:

INTEGER	I,LOC
CHARACTER*26	UPPER,LOWER

COMMON Blocks: None

SUBROUTINE USRBCK

Argument Declarations:

IBKGD - INTEGER Variable (Output) - Background index

PARAMETER Declarations:

```
      INTEGER          NMATL,NSCEN,MAXLAT,MAXLON,MOLMAX
      PARAMETER        (NMATL=28, NSCEN=35, MAXLAT=3, MAXLON=1)
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          IGTINT
      REAL             GETVAR
      CHARACTER*3      UPCASE
      CHARACTER*72     IOERR
      EXTERNAL         IGTINT,GETVAR,GETVEC,IGTVEC,RDLINE,PARSE,
                         BKGDBD,SCENBD,UPCASE,IOERR,CHRCBD,DEVCBD
```

Local Variable Declarations:

```
      INTEGER          I,J,K,IOS,N,JBCK,NVAR,ICOL0,ICOL40,JBCK2,NVAR4
      REAL             DUMVEC(4),SLPSD
      CHARACTER*1      DOT
      CHARACTER*20     VRDATA(5)
      CHARACTER*80     DUMMY
      CHARACTER*255    VARIAB
```

COMMON Blocks: /BACKGD/,/CHRCNM/,/DEVICE/,/SCENES/

SUBROUTINE USRCLD

Argument Declarations:

CLDBSU - REAL Variable (Output) - Cloud base altitude (km)
CLDTPU - REAL Variable (Output) - Cloud top altitude (km)

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          IGTINT
      REAL             GETVAR
      CHARACTER*3      UPCASE
      CHARACTER*72     IOERR
      EXTERNAL         IGTINT,GETVAR,RDLINE,PARSE,UPCASE,IOERR,CLDRBD,
                         DEVCBD
```

Local Variable Declarations:

```
      INTEGER          I,IOS,NVAR,ICOL0,ICOL40,NVAR6,NVAR8
      CHARACTER*1      DOT
      CHARACTER*20     VRDATA(8)
      CHARACTER*80     TITLE,DUMMY
      CHARACTER*255    VARIAB
```

COMMON Blocks: /CLDRN/,/CLDUSR/,/DEVICE/

SUBROUTINE USRDEF

Argument Declarations:

```
  NFILE  - INTEGER Variable (Input) - Device number
  HXTRA  - REAL Vector (Len = Unspecified) (Input/Output) - Extra
             altitudes (km)
  NXTRA  - INTEGER Variable (Input/Output) - Number of extra altitudes
  RE     - DOUBLE PRECISION Variable (Output) - Earth radius (km)
  ISWTCH - INTEGER Variable (Input) - Switch for different files
```

PARAMETER Declarations:

```
      INTEGER           MLMAX,NASMAX,NL,MAXLAT,MAXLON,NAZMAX,NGMAX,
                          NZSMAX,ISMX,NVSMAX,MOLMAX,MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NL=50, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (NVSMAX=20)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT,MDLATM
      REAL              XMCONV,GETVAR,XTERP
      CHARACTER*1       LWCASE
      CHARACTER*3       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         MAX,SQRT,COS,SIN,DBLE,MIN,ABS,INT,REAL
      EXTERNAL          ATMSBD,XMCONV,RDLINE,GETVAR,XTERP,PARSE,MDLATM,
                          IGTINT,EXMLBD,STMLBD,UPCASE,LWCASE,GBLBCK,
                          IOERR
```

Local Variable Declarations:

```
      INTEGER           K,L,IOS,NDATA,ICOL0,ICOL40,ITRP0,ITRP1,KK,LL,
                          NVAR10,NVAR12,INDXP(MLMAX),ISCENE,MX1,MX2,
                          INDXT(MLMAX),INDXM(ISMX,MLMAX),MLAT
      REAL              T0,P0,TORR,REX,PX,TX,TMIDN,TNOON,FRSNWP,FRICOP,
                          FACLAT,ABSLAT,PX1,PX2,TX1,TX2,CX1,CX2,FRWTRP
      LOGICAL           FLRD2,FLRD3,FLRD4,FLRD5,FLRD6
      CHARACTER*1       DOT
      CHARACTER*20      VRDATA(15)
      CHARACTER*80      TITLE,DUMMY
      CHARACTER*255     VARIAB

COMMON Blocks:          /ATMDAT/,/CONSTN/,/EXTMOL/,/HEADER/,/MOLECP/,
                          /STDMOL/,/USERDF/,/USERNM/
```

REAL FUNCTION VIRIAL

Argument Declarations:

```
  T      - REAL Variable - Temperature (K)
  WH2O   - REAL Variable - Water vapor content (ppm)
  INDX   - REAL Variable - Index for virial coefficient
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP,VIRLBD
```

Local Variable Declarations:

```
      REAL              AAA,AWW,AWWW,AAW,X
```

COMMON Blocks: /VIRDAT/

REAL FUNCTION VISRH

Argument Declarations:

```
  RH     - REAL Variable - Relative humidity (fraction)
  IAERO  - INTEGER Variable - Aerosol index
             IAERO =  1 implies Rural
             IAERO =  2 implies Urban
             IAERO =  3 implies Maritime
             IAERO =  4 implies Oceanic
             IAERO =  5 implies Tropospheric
             IAERO =  6 implies Desert
             IAERO =  7 implies Advection Fog
             IAERO =  8 implies Radiation Fog
             IAERO =  9 implies Light Rural Fog
             IAERO = 10 implies Light Urban Fog
             IAERO = 11 implies Light Maritime Fog
             IAERO = 12 implies Undefined
             IAERO = 13 implies Light Tropospheric Fog
```

Local Variable Declarations:

```
      REAL              VIS0(13),EXPN(13)
```

COMMON Blocks: None

SUBROUTINE VSA

Argument Declarations:

```
  VIS    - REAL Array (Dim = MAXLAT x Unspecified) (Input) - Sea level
             visible range (km)
  CEILHT - REAL Variable (Input) - Cloud ceiling altitude (km)
  DEPTH  - REAL Variable (Input) - Cloud/fog depth (km)
  ZINVHT - REAL Variable (Input) - Altitude of inversion or boundary layer
             (km)
  NLAT   - INTEGER Variable (Input) - Number of latitudes
  NLON   - INTEGER Variable (Input) - Number of longitudes
```

PARAMETER Declarations:

```
      INTEGER           NVSA,MAXLAT,MAXLON
      PARAMETER         (NVSA=9, MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,EXP,MIN,LOG
```

Local Variable Declarations:

```
      INTEGER           IFOG,IVSA,I,K,KK,LL
      REAL              ZT,ZC,A(2),B(2),C(2),FAC1(9),FAC2(9),ZHIGH,D,
                          ZINV,E,ZALGO,ANUM,F
```

COMMON Blocks: /VSADTA/

REAL FUNCTION XMCONV

Argument Declarations:

```
  ZUSER  - REAL Variable - User-defined altitude (km)
  AUSER  - REAL Variable - User-defined molecular concentration
  INDX   - INTEGER Variable - Units index for AUSER
             INDX =0 implies that molecular profile for M2 is to be used
             INDX =1 implies that AUSER is provided in volume mixing ratio (ppmv)
             INDX =2 implies that AUSER is provided in number density (cm^-3)
             INDX =3 implies that AUSER is provided in mass mixing ratio (gm/kg)
             INDX =4 implies that AUSER is provided in mass density (gm/m^3)
             INDX =5 implies that AUSER is provided in partial pressure (mb)
             INDX =6 implies that AUSER is provided in dew point
                       temperature (K) (water vapor only)
             INDX =7 implies that AUSER is provided in dew point
                       temperature (deg. C) (water vapor only)
             INDX =8 implies that AUSER is provided in relative
                       humidity (per cent) (water vapor only)
  PRESS  - REAL Variable - Pressure at altitude Z (mb)
  TEMP   - REAL Variable - Temperature at altitude Z (K)
  Z      - REAL Vector (Len = Unspecified) - Altitude array (km)
  AMOL   - REAL Vector (Len = Unspecified) - Molecular concentration
             used if INDX =0 (ppmv)
  NL     - INTEGER Variable - DIMENSION of Z and AMOL
  KTYPE  - INTEGER Variable - Molecular index
             KTYPE=1 implies water vapor
```

PARAMETER Declarations:

```
      INTEGER          MLIDMX
      PARAMETER        (MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             XTERP,SATUR
      EXTERNAL         XTERP,SATUR,MOLPBD
```

Local Variable Declarations:

```
      INTEGER          ITYPE0,ITYPE1,ITRP0
      REAL             T0,AVOGAD,XLOSMT,TT,EW,RHDUM
```

COMMON Blocks: /MOLDAT/

SUBROUTINE XPNDAR

Argument Declarations:

```
  X      - REAL Vector (Len = Unspecified) (Input) - X-array
  Y      - REAL Vector (Len = Unspecified) (Input/Output) - Y-array
  N1     - INTEGER Variable (Input) - Length of X,Y-arrays already filled
  N2     - INTEGER Variable (Input) - Length of Y-array to be filled
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           NP,I,ITRP1
```

COMMON Blocks: None

REAL FUNCTION XTERP

Argument Declarations:

```
  X0     - REAL Variable - Value of X for which Y(X0) is to be found
  X      - REAL Vector (Len = Unspecified) - X-array (must be
             monotonically increasing)
  Y      - REAL Vector (Len = Unspecified) - Y-array as a function of X-array
  N      - INTEGER Variable - DIMENSION of X- and Y-arrays
  NTYPE  - INTEGER Variable - Index for the type of interpolation
             NTYPE = 0 implies linear interpolation
             NTYPE = 1 implies exponential interpolation
             NTYPE = 2 implies that Y(COS(X)), where X is in degrees
               and linear interpolation
             NTYPE = 3 implies that Y(COS(X)^2), where X is in
               degrees and linear interpolation
             NTYPE = 4 implies that Y(1/X) with linear interpolation
             NTYPE = 5 implies that Y(1/X) with exponential interpolation
             NTYPE = 6 implies that X is cyclical (i.e., X(1) follows X(N))
               with linear interpolation; it is assumed that 0 <= X <= 1.
             NTYPE = 7 implies an Aitken iterated polynomial
               interpolation.  N must be less than or equal to NAIT.
```

PARAMETER Declarations:

```
      INTEGER           NAIT
      PARAMETER         (NAIT=100)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IBNSRC
      INTRINSIC         MAX,MIN,ABS,COS
      EXTERNAL          IBNSRC
```

Local Variable Declarations:

```
      INTEGER           J,K,KEY,KEYP
      REAL              FAC,DX,Z0,Z1,Z2,DZ,DUM,P(NAIT),Q(NAIT)
```

COMMON Blocks: /CONSTN/

REAL FUNCTION ZLAT

Argument Declarations:

```
  XLMBDA - REAL Variable - Geocentric ecliptic longitude
  BETA   - REAL Variable - Geocentric ecliptic latitude
  LABSUN - REAL Variable - Earth heliocentric latitude
  DIST   - REAL Variable - Distance of the band
  ASC    - REAL Variable -
  FI     - REAL Variable -
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         ABS,MOD,MAX,MIN,COS,ACOS,SIN,ASIN,SQRT
```

Local Variable Declarations:

```
      REAL              PHI,PHI0,R,BETSOL,XX0,YY0,ZZ0,ANG,SNLONG,VAR,
                          SOBLON,SE
```

```
COMMON Blocks:          /CONSTN/
```

REAL FUNCTION ZODICL

Argument Declarations:

```
  XLMBDA - REAL Variable - Ecliptic longitude (deg)
  BETA   - REAL Variable - Ecliptic latitude (deg)
  V      - REAL Variable - Wavenumber (cm-1)
  DV     - REAL Variable - Wavenumber increment (cm-1)
  SOLDIS - REAL Variable - Normalized solar distance
  LONG   - REAL Variable - Longitude (in degrees and
             fractions of degrees,   is east)
  DAY    - INTEGER Variable - Day of the month
  MONTH  - INTEGER Variable - Month of the year
  YEAR   - INTEGER Variable - Year
  TIME   - REAL Variable - Time (decimal) local standard (LST)
             or Greenwich mean (GMT)
  ITIME  - INTEGER Variable - Time index
             ITIME = 0 implies local standard time
             ITIME = 1 implies Greenwich mean time
             ITIME = 2 implies local daylight savings time
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              EMISSV,DBANDS
      DOUBLE PRECISION  EPHTIM
      INTRINSIC         REAL,SQRT,DBLE,AINT,INT,ABS,MOD,SIGN,COS,ACOS,
                          SIN
      EXTERNAL          EMISSV,GETGLC,DBANDS,ZOD2BD,EPHTIM
```

Local Variable Declarations:

```
      INTEGER           I,J,NORDER,INDX,ISW
      REAL              ZCUT,RE,RECL,RSYM,ZSYM,FUDGE,XECL,YECL,ZECL,
                          RMAX,XANG,LABSUN,DAYCNT,TEMP,DCIR,ZNLONG,
                          GMTDEG
      DOUBLE PRECISION  RT(512),WT(512),ZOD,DDCIR,GAMMA,CENT,ZDEP,DUST,
                          XSINE,ETIME
```

```
COMMON Blocks:          /CONSTN/,/ZPLANE/
```

SUBROUTINE ZROHDR

Argument Declarations: None

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

Local Variable Declarations:

```
      INTEGER           I,K,M,KK,LL,MM
```

COMMON Blocks: /HEADER/

SUBROUTINE ZROINT

Argument Declarations:

NASPCT - INTEGER Vector (Len = Unspecified) (Input) - Number of earth/skyshine angles
NAZSH - INTEGER Variable (Input) - Number of earth/skyshine azimuths
NAZ - INTEGER Vector (Len = Unspecified) (Input) - Number of observer/source azimuths
BW - REAL Variable (Input/Output) - Bandwidth (cm^{-1})
BWL - REAL Variable (Input/Output) - Bandwidth (μm)

PARAMETER Declarations:

```
      INTEGER           NAZMAX,MLMAX,NASMAX,NZSMAX,NMATL,MAXLAT,MAXLON,
                          NGMAX
      PARAMETER         (NAZMAX=30, NASMAX=15, NZSMAX=4, NGMAX=15)
      PARAMETER         (MLMAX=140, NMATL=28, MAXLAT=3, MAXLON=1)
```

Local Variable Declarations:

```
      INTEGER           I,M,MM,LB,IGEOM,LS
```

COMMON Blocks: /BCKDAT/,/INTSTO/

BLOCK DATA ARSABD

PARAMETER Declarations:

```
      INTEGER          NWLAER,NWLCLD
      PARAMETER        (NWLAER=47, NWLCLD=79)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /AERSLA/

BLOCK DATA ARSLBD

PARAMETER Declarations:

```
      INTEGER          NWLAER,NWLCLD,NANG
      PARAMETER        (NWLAER=47, NWLCLD=79, NANG=65)
```

Local Variable Declarations:

```
      INTEGER          J,K
```

COMMON Blocks: /AEROSL/

BLOCK DATA ARSXBD

PARAMETER Declarations:

```
      INTEGER          NWLAER,NWLCLD
      PARAMETER        (NWLAER=47, NWLCLD=79)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /AERSLX/

BLOCK DATA ATMSBD

PARAMETER Declarations:

```
      INTEGER          NL,MAXLAT,MAXLON
      PARAMETER        (NL=50, MAXLAT=3, MAXLON=1)
```

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /ATMDAT/

BLOCK DATA BKGDBD

PARAMETER Declarations:

```
      INTEGER           NMATL,MAXLAT,MAXLON
      PARAMETER         (NMATL=28, MAXLAT=3, MAXLON=1)
```

Local Variable Declarations:

```
      INTEGER           I
```

COMMON Blocks: /BACKGD/

BLOCK DATA BKSTBD

PARAMETER Declarations:

```
      INTEGER           NWLAER,NSTTMP
      PARAMETER         (NWLAER=47, NSTTMP=16)
```

Local Variable Declarations:

```
      INTEGER           I
```

COMMON Blocks: /BSTAER/

BLOCK DATA BRBNBD

COMMON Blocks: /CLDPAR/,/FLXTAB/,/SWPARM/

BLOCK DATA CFCBD

Local Variable Declarations:

```
      INTEGER           I,J
```

COMMON Blocks: /CFCBM/

BLOCK DATA CHRCBD

Local Variable Declarations:

```
      INTEGER           I
```

COMMON Blocks: /CHRCNM/

BLOCK DATA CIRRBD

PARAMETER Declarations:

```
      INTEGER          NWLAER,NWLCLD
      PARAMETER        (NWLAER=47, NWLCLD=79)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /CRASYM/

BLOCK DATA CLDRBD

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /CLDRN/

BLOCK DATA CROSBD

Local Variable Declarations:

```
      INTEGER          I,J
```

COMMON Blocks: /CRSECT/

BLOCK DATA DEVCBD

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

COMMON Blocks: /DEVCNM/,/DEVICE/,/MACHIN/

BLOCK DATA DSRTBD

PARAMETER Declarations:

```
      INTEGER          NWLAER
      PARAMETER        (NWLAER=47)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /DESDAT/

BLOCK DATA ECOSBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /ECOCNV/,/ECOSYS/

BLOCK DATA EMISBD

PARAMETER Declarations:

```
      INTEGER          NLMAX
      PARAMETER        (NLMAX=10)
```

Local Variable Declarations:

```
      INTEGER          I,L
```

COMMON Blocks: /CDRYDS/,/WETNES/

BLOCK DATA EXMLBD

PARAMETER Declarations:

```
      INTEGER          NL
      PARAMETER        (NL=50)
```

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /EXTMOL/

BLOCK DATA GLCFBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /GAUSSL/

BLOCK DATA H2OBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /CONTNS/

BLOCK DATA HAZEBD

PARAMETER Declarations:

```
      INTEGER          NZBNDR,NZTROP,NZSTRA,NZUPR
      PARAMETER        (NZBNDR=3, NZTROP=9, NZSTRA=17, NZUPR=14)
```

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /HZDATA/

BLOCK DATA ICEBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /ICEREF/

BLOCK DATA INFLBD

Local Variable Declaration

```
      INTEGER          I
```

COMMON Blocks: /INFLTR/

BLOCK DATA INPTBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /INPTDT/,/INPNDX/

BLOCK DATA LAGRBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /LAGUER/

BLOCK DATA LUNPBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /PERLUN/

BLOCK DATA MARNBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /NAVMAR/

BLOCK DATA MOLNBD

PARAMETER Declarations:

```
      INTEGER          NSMX,MLIDMX
      PARAMETER        (MLIDMX=45, NSMX=MLIDMX+8)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /MOLNMX/

BLOCK DATA MOLPBD

PARAMETER Declarations:

```
      INTEGER          MLMAX,MAXLAT,MAXLON,MLIDMX
      PARAMETER        (MLMAX=140, MLIDMX=45)
      PARAMETER        (MAXLAT=3, MAXLON=1)
```

Local Variable Declarations:

```
      INTEGER          I,J
```

COMMON Blocks: /MOLCON/,/MOLDAT/

BLOCK DATA NO2BD

PARAMETER Declarations:

INTEGER	NMAX
PARAMETER	(NMAX=7176)

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /NO2XS/

BLOCK DATA O2CBD

COMMON Blocks: /O2C/

BLOCK DATA O2UVBD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /HERZBG/,/SHURUN/

BLOCK DATA O3CWBD

PARAMETER Declarations:

INTEGER	NMAX
PARAMETER	(NMAX=3080)

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /O3CWB/

BLOCK DATA O3HHBD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /O3HHB/

BLOCK DATA OCNTBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /TMPOCN/

BLOCK DATA PHFGBD

PARAMETER Declarations:

```
      INTEGER          NWLAER,NANG
      PARAMETER        (NWLAER=47, NANG=65)
```

Local Variable Declarations:

```
      INTEGER          J,K
```

COMMON Blocks: /PHFFOG/

BLOCK DATA PHHYBD

PARAMETER Declarations:

```
      INTEGER          NWLCLD
      PARAMETER        (NWLCLD=79)
```

Local Variable Declarations:

```
      INTEGER          J
```

COMMON Blocks: /PHHYDR/

BLOCK DATA PHMABD

PARAMETER Declarations:

```
      INTEGER          NANG
      PARAMETER        (NANG=65)
```

Local Variable Declarations:

```
      INTEGER          J,K
```

COMMON Blocks: /PHFMAR/

BLOCK DATA PHOCBD

PARAMETER Declarations:

INTEGER	NANG
PARAMETER	(NANG=65)

Local Variable Declarations:

INTEGER	J,K

COMMON Blocks: /PHFOCE/

BLOCK DATA PHRUBD

PARAMETER Declarations:

INTEGER	NANG
PARAMETER	(NANG=65)

Local Variable Declarations:

INTEGER	J,K

COMMON Blocks: /PHFRUR/

BLOCK DATA PHSTBD

PARAMETER Declarations:

INTEGER	NANG
PARAMETER	(NANG=65)

Local Variable Declarations:

INTEGER	J,K

COMMON Blocks: /PHFSTR/

BLOCK DATA PHTRBD

PARAMETER Declarations:

INTEGER	NANG
PARAMETER	(NANG=65)

Local Variable Declarations:

INTEGER	J,K

COMMON Blocks: /PHFTRP/

BLOCK DATA PHURBD

PARAMETER Declarations:

```
      INTEGER          NANG
      PARAMETER        (NANG=65)
```

Local Variable Declarations:

```
      INTEGER          J,K
```

COMMON Blocks: /PHFURB/

BLOCK DATA RAINBD

PARAMETER Declarations:

```
      INTEGER          NWLCLD
      PARAMETER        (NWLCLD=79)
```

Local Variable Declarations:

```
      INTEGER          J
```

COMMON Blocks: /RAINTP/,/RAINWL/

BLOCK DATA REFRBD

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /MMWREF/

BLOCK DATA SCENBD

PARAMETER Declarations:

```
      INTEGER          NSCEN,NMATL
      PARAMETER        (NSCEN=35, NMATL=28)
```

Local Variable Declarations:

```
      INTEGER          K
```

COMMON Blocks: /SCENES/

BLOCK DATA SICEBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SICEDT/

BLOCK DATA SNOWBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SNWDAT/

BLOCK DATA SO2BD

PARAMETER Declarations:

```
      INTEGER          NMAX
      PARAMETER        (NMAX=5562)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SO2XS/

BLOCK DATA SLR1BD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SOLIR1/

BLOCK DATA SLR2BD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SOLIR2/

BLOCK DATA SLR3BD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /SOLIR3/

BLOCK DATA SLR4BD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /SOLIR4/

BLOCK DATA SLR5BD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /SOLIR5/

BLOCK DATA STMLBD

PARAMETER Declarations:

INTEGER	NL
PARAMETER	(NL=50)

Local Variable Declarations:

INTEGER	L

COMMON Blocks: /STDMOL/

BLOCK DATA UFTPBD

Local Variable Declarations:

INTEGER	I

COMMON Blocks: /UFTAPE/

BLOCK DATA UPPRBD

PARAMETER Declarations:

```
      INTEGER          MAXLAT,MAXLON,NLUPR,NTEXO
      PARAMETER        (MAXLAT=3, MAXLON=1, NLUPR=8, NTEXO=11)
```

Local Variable Declarations:

```
      INTEGER          L
```

COMMON Blocks: /UPRATM/

BLOCK DATA VIRLBD

COMMON Blocks: /VIRDAT/

BLOCK DATA WTRBD

PARAMETER Declarations:

```
      INTEGER          NWLWTR,NFRQ
      PARAMETER        (NWLWTR=169, NFRQ=28)
```

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /INDXWR/

BLOCK DATA ZOD1BD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /SILEMS/

BLOCK DATA ZOD2BD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /ZODBND/,/ZPLANE/

PROGRAM ASCBIN

PARAMETER Declarations:

```
      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*1       UPCASE
      CHARACTER*72      IOERR
      EXTERNAL          CONVAB,TABLEA,TABLEB,TABLEH,DEVCBD,FILRT,
                          SETFIL,PROMPT,CONFIG,UPCASE,IOERR,CNSTNT
```

Local Variable Declarations:

```
      INTEGER           K,KTER,IWORK,IFBIN,JASC,JTBL,IERR,IOS
      CHARACTER*1       CX
      CHARACTER*40      FILERT
      CHARACTER*80      FILENM(17),FILBIN
```

COMMON Blocks: /DEVCNM/,/DEVICE/

SUBROUTINE CONVAB

Argument Declarations:

```
  ICONV  - INTEGER Variable (Input) - Index for type of conversion
             ICONV = 0 implies a binary to ASCII conversion
             Otherwise, an ASCII to binary conversion
  IFBIN  - INTEGER Variable (Input) - Binary file unit number
  FILBIN - CHARACTER*(*) Variable (Input) - Binary file name
  IFASC  - INTEGER Variable (Input) - ASCII file unit number
  FILASC - CHARACTER*(*) Variable (Input) - ASCII file name
  IERR   - INTEGER Variable (Output) - Error index
```

PARAMETER Declarations:

```
      INTEGER           NVSMAX,NGMAX
      PARAMETER         (NVSMAX=20, NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          SETFIL,IOERR
```

Local Variable Declarations:

```
      INTEGER           NHDR(2),NVAR(NGMAX),IV,IVSET,IVS,IG,NVSET,
                          NVS(NVSMAX),IH,IOS,ITER,JTER,IHDR(2000),
                          NGEOM,IVSETX,IVSX,IGEOM
      REAL              HDR(2500),VAR(10000)
      CHARACTER*1       DUMMY
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE
```

COMMON Blocks: None

SUBROUTINE SETFIL

Argument Declarations:

```
  NFILE  - INTEGER Variable (Input) - File unit number
  FILNAM - CHARACTER*(*) Variable (Input) - File name
  IERR   - INTEGER Variable (Output) - Error index
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           IOS
      LOGICAL           FXST
      CHARACTER*11      FMT(2)
```

COMMON Blocks: None

SUBROUTINE SLITFN

Argument Declarations:

```
  X      - REAL Vector (Len = Unspecified) (Input/Output) - Element
             of variables being convolved with slit function
  SLIT   - REAL Array (Dim = NDV x Unspecified) (Input/Output) -
             Running of convolved value (temporary storage)
  SUM    - REAL Vector (Len = Unspecified) (Input/Output) - Running
             integral of slit function (temporary storage)
  VP     - REAL Vector (Len = Unspecified) (Input/Output) - Previous
             wavenumbers (cm-1)
  DVP    - REAL Vector (Len = Unspecified) (Input/Output) - Previous
             spectral increment (cm-1)
  NDV    - INTEGER Variable (Input) - Maximum number of spectral points
  NDAT   - INTEGER Variable (Input) - Number of data sets
  V      - REAL Variable (Input) - Wavenumber (cm-1)
  DV     - REAL Variable (Input) - Spectral increment (cm-1)
  RESOL  - REAL Variable (Input) - Slit full width at half maximum (cm-1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MAX,ABS
```

Local Variable Declarations:

```
      INTEGER           I,J,IP
      REAL              WGT
```

COMMON Blocks: None

SUBROUTINE TABLEA

Argument Declarations:

```
  IFATM  - INTEGER Variable (Input) - Source binary file number
  IFTBL  - INTEGER Variable (Input) - Tabular file unit number
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,MLMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,
                          ISMX,NVSMAX,MOLMAX,NDV,NSLTD
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NVSMAX=20, NDV=200, NSLTD=5)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              FILTER
      CHARACTER*4       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         MOD
      EXTERNAL          GETHDR,PROMPT,IOERR,FILTER,SLITFN,UPCASE,RDFLTR
```

Local Variable Declarations:

```
      INTEGER           IPRNT,M,KAZ,MM,MMP,IG,IVP,K,IOS,NBCKZ,ML0,
                          NVAR(NGMAX),IGEOM,IGX,JMOD,IFLTR,IV,IVS
      REAL              TAUSH(NASMAX,NZSMAX),RADSH(NASMAX,NZSMAX),FLTR,
                          RADT(NAZMAX),WL,VWL,RADSE(NASMAX,NZSMAX),
                          RADSS(NASMAX,NZSMAX),RADSC(NASMAX,NZSMAX),
                          RDSLST(NAZMAX),DV(NDV),RDSLSB(NAZMAX),RESX,
                          RADBE(NAZMAX),TAUT(NAZMAX),SIGMET(NAZMAX),
                          RADBR(NAZMAX),RADSD(NAZMAX),RADLNT(NAZMAX),
                          ZBCKZ(MLMAX),DRADT(NAZMAX),TAUSCT(NAZMAX),
                          TAUB(NAZMAX),RADB(NAZMAX),TAUSCB(NAZMAX),
                          RADSLT(NAZMAX),DRADB(NAZMAX),SUM(NSLTD),
                          SWBCK(MLMAX,NGMAX),TBCK(MLMAX,MAXLAT,MAXLON),
                          ZL(MLMAX),SIGMEB(NAZMAX),SLIT(NDV,NSLTD),DV0,
                          XSLIT(NSLTD),SUMSLT(NDV),V(NDV),RES,RESWL,V0,
                          LATST(MAXLAT),LONST(MAXLON)
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE,FILENM
```

COMMON Blocks: /HEADER/

SUBROUTINE TABLEB

Argument Declarations:

```
  IFBCK  - INTEGER Variable (Input) - Background binary file number
  IFTBL  - INTEGER Variable (Input) - Tabular file unit number
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,MLMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,
                          ISMX,NVSMAX,MOLMAX,NDV,NSLTD
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NVSMAX=20, NDV=200, NSLTD=5)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              FILTER
      CHARACTER*4       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         MOD
      EXTERNAL          GETHDR,PROMPT,IOERR,FILTER,SLITFN,UPCASE,RDFLTR
```

Local Variable Declarations:

```
      INTEGER           IPRNT,IZ,M,KAZ,IZBCK,IG,MM,IV,K,NBCKZ,IOS,
                          ML0,NVAR(NGMAX),IGEOM,IGP,IVS,IVP,IFLTR,JMOD
      REAL              ZBCKZ(MLMAX),TAUBZ(NAZMAX,MLMAX),RES,RESWL,
                          SIGMEZ(NAZMAX,MLMAX),TAUSCZ(NAZMAX,MLMAX),
                          RADBZ(NAZMAX,MLMAX),WL,VWL,FLTR,RESX,
                          DRADZ(NAZMAX,MLMAX),DV(NDV),SUM(NSLTD),
                          RDSLBZ(NAZMAX,MLMAX),RDLNBZ(NAZMAX,MLMAX),
                          RDSCBZ(NAZMAX,MLMAX),RADSHB(NAZMAX,MLMAX),
                          RDSHSB(NAZMAX,MLMAX),ZL(MLMAX),V0,DV0,
                          SWBCK(MLMAX,NGMAX),TBCK(MLMAX,MAXLAT,MAXLON),
                          XSLIT(NSLTD),SLIT(NDV,NSLTD),V(NDV),
                          SUMSLT(NDV),LATST(MAXLAT),LONST(MAXLON)
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE,FILENM

COMMON Blocks:          /HEADER/
```

SUBROUTINE TABLEH

Argument Declarations:

```
  IFHTR  - INTEGER Variable (Input) - Heat transfer binary file number
  IFTBL  - INTEGER Variable (Input) - Tabular file unit number
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                          NTIME,MLMAX,NVSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NTIME=97, NVSMAX=20)
      PARAMETER         (MAXLAT=3, MAXLON=1, MLMAX=140)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         MOD
      EXTERNAL          GETHDR,PROMPT,IOERR
```

Local Variable Declarations:

```
      INTEGER           L,L0,KK,LL,IOS,ITM,IZ,NBCKZ,ML0,NVAR(NGMAX),
                          ITIM
      REAL              DECTIM(NTIME),SOLEVX(NTIME,MAXLAT,MAXLON),
                          BSWZ(10,NTIME,MAXLAT,MAXLON),LATST(MAXLAT),
                          USWZ(10,NTIME,MAXLAT,MAXLON),LONST(MAXLON),
                          DSWZ(10,NTIME,MAXLAT,MAXLON),
                          ULWZ(10,NTIME,MAXLAT,MAXLON),
                          DLWZ(10,NTIME,MAXLAT,MAXLON),
                          SWBCK(MLMAX,NGMAX),ZBCKZ(MLMAX),ZLYR(10),
                          TLYR(10,NTIME,MAXLAT,MAXLON),
                          RHLYR(10,NTIME,MAXLAT,MAXLON),
                          SOLAZX(NTIME,MAXLAT,MAXLON),ZL(MLMAX),
                          TBCK(MLMAX,MAXLAT,MAXLON)
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE
```

COMMON Blocks: /HEADER/

SUBROUTINE TABLET

Argument Declarations:

```
  IFTRN  - INTEGER Variable (Input) - Molecular transmittance binary file
             number
  IFTBL  - INTEGER Variable (Input) - Tabular file unit number
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
     +                    MLMAX,NVSMAX,MOLMAX,NSLTD,NDV,MLIDMX,NSMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NVSMAX=20, NSLTD=4, NDV=200)
      PARAMETER         (MAXLAT=3, MAXLON=1, MLMAX=140)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MLIDMX=45, NSMX=MLIDMX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              FILTER
      CHARACTER*4       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         MOD,INT,MIN
      EXTERNAL          GETHDR,PROMPT,IOERR,FILTER,SLITFN,UPCASE,MOLNBD
```

Local Variable Declarations:

```
      INTEGER           M,N,KAZ,MM,IG,IVP,K,IOS,NBCKZ,ML0,MOLX,IM,IM1,
     +                    NVAR(NGMAX),IGEOM,IGX,JMOD,IV,IVS,IM2,IM3,
     +                    NMOLEC,MOLID(NSMX),IM4
      REAL              WL,DV(NDV),RESX,ZBCKZ(MLMAX),RESWL,V0,
     +                    SWBCK(MLMAX,NGMAX),SUMSLT(NDV),V(NDV),RES,
     +                    TBCK(MLMAX,MAXLAT,MAXLON),ZL(MLMAX),
     +                    SLIT(NDV,NSLTD),DV0,XSLIT(NSLTD),
     +                    TAULR(NAZMAX),SPCTRN(ISMX,3,NAZMAX),
     +                    LATST(MAXLAT),LONST(MAXLON)
      CHARACTER*40      HEADNG
      CHARACTER*80      TITLE
```

COMMON Blocks: /HEADER/,/MOLNMX/

```
                                PROGRAM BBTEMP

PARAMETER Declarations:

      INTEGER           NGMAX,NAZMAX,NASMAX,NZSMAX,MLMAX,MAXLAT,MAXLON,
                          ISMX,NVSMAX,MOLMAX,MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (NVSMAX=20)

INTRINSIC and EXTERNAL Declarations:

      REAL              INVPLK,FILTER
      CHARACTER*72      IOERR
      INTRINSIC         REAL,DBLE,SQRT,COS,SIN
      EXTERNAL          CNSTNT,DEVCBD,SUMFIL,GETHDR,INVPLK,FILTER,
                          RDFLTR,PROMPT,CONFIG,SETFLG,IOERR,FILRT

Local Variable Declarations:

      INTEGER           IOS,IG,IV,MM,M,IFLTR,IVS,NBCKZ,ML0,NVAR(NGMAX),
                          IGP,IGEOM,IGX
      REAL              V,DV,ZBCK(MLMAX),SWBCK(MLMAX,NGMAX),WL,TMP1,
                          TAUT(NAZMAX),TMP2,DRADT(NAZMAX),TMPBCK,WL1,
                          RADSLT(NAZMAX),RADBT(NAZMAX),SIGMET(NAZMAX),
                          TAUSCT(NAZMAX),RADLNT(NAZMAX),TAUB(NAZMAX),
                          RADSH,SIGMEB(NAZMAX),TMPDRT,TAUSCB(NAZMAX),
                          RADSD(NAZMAX),VBAR,TMPSL,TMPLN,TMPSDT,RADSS,
                          RDSLST(NAZMAX),RDSLSB(NAZMAX),RADB(NAZMAX),
                          RADBE(NAZMAX),RADBR(NAZMAX),TMPBE,TMPBR,WL2,
                          RADT(NAZMAX),TAU1(NAZMAX),TAU2(NAZMAX),RADSC,
                          RAD1(NAZMAX),RAD2(NAZMAX),TMPSLT,TMPSLB,
                          DRADTT(NAZMAX),DRADBT(NAZMAX),BW,BWL,DFLT,
                          SGMETT(NAZMAX),SGMEBT(NAZMAX),ZL(MLMAX),
                          TASCTT(NAZMAX),TASCBT(NAZMAX),RADSDT(NAZMAX),
                          RDSLT(NAZMAX),RDLNT(NAZMAX),TMPDRB,DUM,
                          RSLSTT(NAZMAX),RADBET(NAZMAX),RADBRT(NAZMAX),
                          TAUSH,TBCK(MLMAX,MAXLAT,MAXLON),RADSE,
                          DRADB(NAZMAX),RSLSBT(NAZMAX),LATST(MAXLAT),
                          LONST(MAXLON)
      DOUBLE PRECISION  RE,REPOL,REEQU
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG,FILERT
      CHARACTER*50      TLBL(18)
      CHARACTER*80      TITLE,FILENM(14),NFFLTR

COMMON Blocks:          /CONSTN/,/DEVICE/,/FLAGS/ ,/HEADER/,/MOLECP/,
                          /USERNM/
```

REAL FUNCTION INVPLK

Argument Declarations:

RADNCE - REAL Variable - Radiance ($W/cm^2/sr/cm^{-1}$).
V - REAL Variable - Wavenumber (cm^{-1})

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC        REAL,DBLE,LOG
```

Local Variable Declarations:

```
      DOUBLE PRECISION X,Y,C1,C2
```

COMMON Blocks: /CONSTN/

SUBROUTINE CNVJTK

Argument Declarations:

JCHAR - CHARACTER*(*) Vector (Len = Unspecified) - MODTRAN string
KNDX - INTEGER Vector (Len = Unspecified) - MOSART string

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      INTRINSIC        LEN
      EXTERNAL         IOERR
```

Local Variable Declarations:

```
      INTEGER          K,IOS
      CHARACTER*6      F
```

COMMON Blocks: None

SUBROUTINE CRBKGD

Argument Declarations:

IFUBK - INTEGER Variable (Input) - Background file number
FILNAM - CHARACTER*(*) Variable (Input) - Input file name
IERR - INTEGER Variable (Output) - Error index

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      EXTERNAL         INBKBD,DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER          I,IOS
      LOGICAL          FXSUBK
```

COMMON Blocks: /INBKGD/,/MACHIN/

PROGRAM CRFILE

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      EXTERNAL         DEVCBD,FILRT,MENU,CRINPT,CRFLTR,CRBKGD,CRUATM,
                         CRUCLD,CRUAER,PROMPT,CONFIG,RDMDTN,IOERR
```

Local Variable Declarations:

```
      INTEGER          IWORK,IERR,IOS,INDXI
      CHARACTER*40     FILERT
      CHARACTER*80     FILENM(17)
```

COMMON Blocks: /DEVICE/

SUBROUTINE CRFLTR

Argument Declarations:

```
  IFFLT  - INTEGER Variable (Input) - Filter response file number
  FILNAM - CHARACTER*(*) Variable (Input) - Input file name
  IERR   - INTEGER Variable (Output) - Error index
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER          LENSTR
      CHARACTER*1      UPCASE
      CHARACTER*72     IOERR
      EXTERNAL         INFLBD,DEVCBD,IOERR,PROMPT,UPCASE,LENSTR,LCTRIM
```

Local Variable Declarations:

```
      INTEGER          I,IOS,IFLTSW,NFLTR,IFMOD,NF,NEW,IFT,IPRINT,
                         KODE,NLOW,IFWV,NW,LENF
      REAL             WLF(200),FLTR(200),TEMP
      LOGICAL          FXSFLT
      CHARACTER*1      RESPON
      CHARACTER*2      WNL(0:1)
      CHARACTER*20     IDFIL
      CHARACTER*24     TFLTR
      CHARACTER*80     NFMOD
```

COMMON Blocks: /INFLTR/,/MACHIN/

SUBROUTINE CRINPT

Argument Declarations:

```
  NILE   - INTEGER Variable (Input) - File number
  FILNAM - CHARACTER*(*) Variable (Input) - Input file name
  IERR   - INTEGER Variable (Output) - Error index
```

PARAMETER Declarations:

```
      INTEGER          NGMAX
      PARAMETER        (NGMAX=15)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             GETVAR
      CHARACTER*1      UPCASE,LWCASE
      CHARACTER*72     IOERR
      EXTERNAL         INPTBD,DEVCBD,MENU,LCTRIM,GETVAR,UPCASE,LWCASE,
                         IOERR,PROMPT,CRUATM,MONTH,IGTINT,CALEND,
                         CHTIME
```

Local Variable Declarations:

```
      INTEGER          I,J,IOS,IMENU(154),LENX
      REAL             HO,HS,SLRNG,BETA,PHIO,PHIS,HT
      LOGICAL          FXSFIL
      CHARACTER*1      RESPON,BLANK,V1,V2
      CHARACTER*40     VARIAB,VX,VY,VZ,VU,VV,VL
      CHARACTER*80     STRING
```

COMMON Blocks: /HEADER/,/INPNDX/,/INPTDT/,/MACHIN/

SUBROUTINE CRUAER

Argument Declarations:

```
  IFUAR  - INTEGER Variable (Input) - Aerosol file number
  FILNAM - CHARACTER*(*) Variable (Input) - Input file name
  IERR   - INTEGER Variable (Output) - Error index
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      EXTERNAL         INARBD,DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER          I,IOS
      LOGICAL          FXSUAR
```

COMMON Blocks: /INUAER/,/MACHIN/

SUBROUTINE CRUATM

Argument Declarations:

```
  IFUAT  - INTEGER Variable (Input) - Atmosphere file number
  FILNAM - CHARACTER*(*) Variable (Input) - Input file name
  IERR   - INTEGER Variable (Output) - Error index
  FLUATM - LOGICAL Variable (Input) - Flag for creation of separate
             user-defined atmosphere file
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INDEX,REAL,LEN,INT,MAX
      EXTERNAL          INPTBD,DEVCBD,IOERR,MSAG,PROMPT,CHTIME,CALEND,
                         GETVAR,IGTINT,UPCASE
```

Local Variable Declarations:

```
      INTEGER           I,IOS
      LOGICAL           FXSUAT
      CHARACTER*50      INPATM(2)
```

COMMON Blocks: /HEADER/,/INPNDX/,/INPTDT/,/MACHIN/

SUBROUTINE CRUCLD

Argument Declarations:

```
  IFUCL  - INTEGER Variable (Input) - Hydrometeor file number
  FILNAM - CHARACTER*(*) Variable (Input) - Input file name
  IERR   - INTEGER Variable (Output) - Error index
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          INCLBD,DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           I,IOS
      LOGICAL           FXSUCL
```

COMMON Blocks: /INUCLD/,/MACHIN/

BLOCK DATA INARBD

Local Variable Declaration

```
      INTEGER           I
```

COMMON Blocks: /INUAER/

BLOCK DATA INBKBD

Local Variable Declaration

```
      INTEGER          I
```

COMMON Blocks: /INBKGD/

BLOCK DATA INCLBD

COMMON Blocks: /INUCLD/

SUBROUTINE MDRI

PARAMETER Declarations:

```
      INTEGER          MOLMAX
      PARAMETER        (MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL             AFTERP,DNO,OHCALC,POZONE,SINTRP,TDEP,VP
      EXTERNAL         AFTERP,DNCALC,DNO,DREAD,GTD6,INTERP,OHCALC,
     +                   POZONE,SINTRP,SUN,TDEP,VP,DEVCBD,NRLBD
```

Local Variable Declarations:

```
      INTEGER          K,KMAX,IXM,IXP
      REAL             D(8),T(2),ALT,APNO,AR72,AR90,CNO,CNODAY,CNONIT,
     +                   CO2AR,CO2MIX,CONC,D40,DAYAV,DAYO,DAYO3,
     +                   DENORM,DENS,DENS8,DN,FLUXC2,FLUXNO,
     +                   H80,O272,O280,O290,O372,O380,O80,O86,ODMS72,
     +                   ODNR72,OH72,OH80,ORATIO,PMBAR,PREVKP,RIS,RLAT,
     +                   RNO100,RNO90,RRLAT,SET,SUNRIS,SUNSET,
     +                   TEMP80,TINF,TK,TMP,TOTN,TROPHT,TROPT,VALUE,
     +                   W1,W2,WT,X120,X150,X300,X90,XO3D,XO3D80,
     +                   XO3N,XO3N80,XOD,XOD80,XON,XON80,NITEO,NITEO3,
     +                   SOD(46),SON(46),SO3D(46),SO3N(46),N280,N272,
     +                   N290,T8,D8
      CHARACTER*80     FILENM
```

COMMON Blocks: /DEVCNM/,/NRLFIL/,/SPECIE/

SUBROUTINE MENU

Argument Declarations:

IMENU - INTEGER Variable (Input) - Menu index

INTRINSIC and EXTERNAL Declarations:

```
CHARACTER*72      IOERR
EXTERNAL          CHRCBD,PROMPT,IOERR
```

Local Variable Declarations:

```
INTEGER           IS(24),IM(24),I,J,IOS
CHARACTER*1       DUMMY
CHARACTER*3       DASH
CHARACTER*3       CHMNTH(12)
CHARACTER*5       CHAER(0:19)
CHARACTER*6       CHATM(0:10),CHAZE(0:9),CHSEA(0:10),CHMES(0:2)
CHARACTER*39      SEAS(4)
```

COMMON Blocks: /CHRCNM/

SUBROUTINE MSAG

Argument Declarations:

```
AP      - REAL Vector (Len = Unspecified) (Input) - Geomagnetic planetary
            indices
F107    - REAL Variable (Input) - Solar Flux at 10.2 cm
F107A   - REAL Variable (Input) - 3-month mean value of solar flux
XLAT    - REAL Variable (Input) - Latitude
XLONG   - REAL Variable (Input) - Longitude
IDAY    - INTEGER Variable (Input) - Day of the month
MONTH   - INTEGER Variable (Input) - Month of the year
IYEAR    - INTEGER Variable (Input) - Year
TIME    - REAL Variable (Input) - Time (decimal) local standard (LST) or
            Greenwich mean (GMT)
ITIME   - INTEGER Variable (Input) - Time index
            ITIME = 0 implies local standard time
            ITIME = 1 implies Greenwich mean time
            ITIME = 2 implies local dayligth saving time
SUNRIS - REAL Variable (Output) - Sunrise (hour)
SUNSET - REAL Variable (Output) - Sunset (hour)
            Continuous day   if SUNRIS = SUNSET =  0.0
            Continuous night if SUNRIS = SUNSET = 24.0
ORATIO - REAL Variable (Output) - 72 km MSIS/NRL O atom ratio
TMPEXO - REAL Variable (Output) - Exospheric temperature (K)
IFUAT  - INTEGER Variable (Output) - Output file index
```

INTRINSIC and EXTERNAL Declarations:

```
DOUBLE PRECISION EPHTIM
INTRINSIC        REAL,MOD
EXTERNAL         MDRI,EPHTIM,CALEND
```

Local Variable Declarations:

```
INTEGER          JULDAY
REAL             DYEAR,UT,XLST
```

COMMON Blocks: None

BLOCK DATA NRLBD

Local Variable Declarations:

```
      INTEGER          I
```

COMMON Blocks: /NRLDEV/,/NRLFIL/,/SPECIE/

SUBROUTINE RDMDTN

Argument Declarations:

IFILE - INTEGER Variable (Input) - File number
FILENM - CHARACTER*(*) Variable (Input) - MOSART input file name

PARAMETER Declarations:

```
      INTEGER          NGMAX,NVSMAX,MLUSR,MOLMAX
      PARAMETER        (NGMAX=15, NVSMAX=20, MLUSR=34, MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      INTRINSIC        REAL,MIN,AINT
      EXTERNAL         PROMPT,INPTBD,CNVJTK,IOERR
```

Local Variable Declarations:

```
      INTEGER          I,J,K,L,IV1,IV2,IDV,IFWHM,IRPT,IVS,IGEOM,IS,IN,
                         ID,MODEL,ITYPE,IEMSCT,M1,M2,M3,M4,M5,M6,MDEF,
                         IRD1,IRD2,IM,NOPRT,IHAZE,ISEASN,IVULCN,IG,
                         ICSTL,ICLD,IVSA,IREG(4),IMULT,NGEOM,NVS,
                         ISEED,IYEAR,IDAY,ISOURC,ML,IPARM,IPH,NANGLS,
                         NATM(0:7),NVS1,NVS2,NCLD(0:11),IOS,MP,MT,
                         IHA1(MLUSR),ICLD1(MLUSR),IVUL1(MLUSR),
                         ISEA1(MLUSR),ICHR1(MLUSR),KNDX(20,MLUSR),
                         IAERO,IZERO,MC(MOLMAX)
      REAL             TBOUND,SALB,VIS,WSS,WHH,RAINRT,CTHIK,CALT,
                         CEXT,HOBS(NGMAX),HSRC(NGMAX),XLAT,XLON,
                         PHIOBS(NGMAX),SLROS(NGMAX),BETAOS(NGMAX),
                         LENP(NGMAX),V1(NVSMAX),V2(NVSMAX),DV(NVSMAX),
                         HBCK,SOLDIS,SOLAT,SOLON,AZIM,AWCCON,
                         SOLAZ,SOLZEN,AHR,SEC,ZCVSA,ZTVSA,ZERO,CN2,
                         ZINVSA,RO,ANGLEM,AMN,TIME,G,ANGF(50),
                         F(4,50),AHAZE(MLUSR),EQLWCZ(MLUSR),AZDUM,
                         RRATZ(MLUSR),ZMDL(MLUSR),P(MLUSR),T(MLUSR),
                         WMOL(12,MLUSR),CLALTB(3),CLALTT(3)
      LOGICAL          FLSUB(17),MODTRN
      CHARACTER*1      JCHAR(14,MLUSR)
      CHARACTER*2      TYGEOM(NGMAX)
      CHARACTER*3      RESPON(4)
      CHARACTER*6      MONTH
      CHARACTER*10     CHGEOM(NGMAX,5)
      CHARACTER*12     CHATM(0:7),CHSEA(0:7),CHAZE(0:8),CHAER1(0:10),
      CHARACTER*32     TITAER
      CHARACTER*40     HEADNG
      CHARACTER*72     HMODEL
      CHARACTER*80     NFMODT,DUMMY(8),INSTR(153)
```

COMMON Blocks: /INPNDX/,/INPTDT/

PROGRAM FACET

PARAMETER Declarations:

```
      INTEGER           NNMAX,NRMAX,NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,
                          MAXLON,ISMX,NVSMAX,MLMAX,MOLMAX,NRFMAX,
                          NSPCT,NZSH,MLIDMX
      PARAMETER         (NNMAX=3, NRMAX=4, MLMAX=140)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (NRFMAX=80, NSPCT=181, NZSH=361)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GETVAR,SHADOW,FILTER,XTERP,SURFAC
      CHARACTER*3       UPCASE
      CHARACTER*4       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         CMPLX,SQRT,COS,SIN,ACOS,ATAN2,REAL,INT,MAX,MIN,
                          ABS
      EXTERNAL          GETVAR,RDLINE,PARSE,UPCASE,SURFAC,CONFIG,
                          CNSTNT,SHADOW,FILTER,RDFLTR,DEVCBD,INFLBD,
                          LWCASE,XTERP,SETFLG,SUMFIL,GETHDR
```

Local Variable Declarations:

```
      INTEGER           I,K,M,N,NBCKZ,ML0,NVAR(NGMAX),IOS,
                          NN,IGEOM,MM,IV,IVS,IG,NPHI,NTHETA,IP,IT,
                          IFLTR,MINV,NSPCTP,NZSHP,IGRID
      REAL              XNORM(NNMAX),RINDEX,IINDEX,ZBCK(MLMAX),V,DV,
                          SWBCK(MLMAX,NGMAX),SIGNAT(NAZMAX),
                          TBCK(MLMAX,MAXLAT,MAXLON),ZL(MLMAX),A,B,
                          TAUT(NAZMAX),SIGMET(NAZMAX),TAUSCT(NAZMAX),
                          RADT(NAZMAX),RADSLT(NAZMAX),RADLNT(NAZMAX),
                          TAUB(NAZMAX),SIGMEB(NAZMAX),TAUSCB(NAZMAX),
                          RADB(NAZMAX),DRADT(NAZMAX),DRADB(NAZMAX),
                          RDSLST(NAZMAX),RDSLSB(NAZMAX),RADBE(NAZMAX),
                          RADBR(NAZMAX),RADSD(NAZMAX),FLTR,VPM,VPP,
                          TAREA(NGMAX,NAZMAX),BKGD(NGMAX,NAZMAX),UP,VP,
                          TAUSH(NASMAX,NZSMAX),CNTRST,DUMAZ(NZSMAX),
                          RADSH(NASMAX,NZSMAX),SNORM(3),PROJA,TNORM,
                          RADSE(NASMAX,NZSMAX),APPS(NGMAX,NAZMAX),
                          PATH(NGMAX,NAZMAX),DPHI,DTHETA,ASH(NZSH),
                          RADSS(NASMAX,NZSMAX),DAREA,DUM,OBS(3),WL2,
                          RADSC(NASMAX,NZSMAX),RCNTR,PSH(NSPCT),WL1,
                          RADSHN(NSPCT,NZSH),ECCEN,LATST(MAXLAT),
                          RSH(NZSH),PSHI(NASMAX),BW(NGMAX),
                          BWL(NGMAX),RSHM(NASMAX,NZSH),LONST(MAXLON)
      LOGICAL           FLTMP
      CHARACTER*1       DOT,DUMMY
      CHARACTER*24      TFLTR,TFLTR0,TFLTRX,GRID(3),REFT(3),RGH(2)
      CHARACTER*25      SHAPE(4)
      CHARACTER*40      VRDATA(NRMAX),HEADNG,NFFCT
      CHARACTER*80      TITLE
      CHARACTER*255     VARIAB,FILENM,FILNAM
```

COMMON Blocks: /CONSTN/,/DEVICE/,/HEADER/,/MATRLD/,/MOLECP/,
/USERNM/

REAL FUNCTION ROUGH

Argument Declarations:

```
  HSIGMA - REAL Variable - Standard deviation of the heights on the
             reflective surface
  WL     - REAL Variable - Wavelength (same units as HSIGMA)
  PSI    - REAL Variable - Elevation angle at the surface (deg)
  ITYPE  - INTEGER Variable - Type of surface
             ITYPE = 0 implies a plane wave on a Gaussian distribution
                       of stepped surfaces
             Otherwise, it implies a spherical wave on a Gaussian
                       distribution of sinusoidal surfaces
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              EHBSL0
      INTRINSIC         SIN,EXP
      EXTERNAL          EHBSL0
```

Local Variable Declarations:

```
      REAL              DUM
```

```
COMMON Blocks:          /CONSTN/
```

REAL FUNCTION SURFAC

Argument Declarations:

```
V      - REAL Variable (Input) - Wavenumber (cm-1)
DV     - REAL Variable (Input) - Wavenumber increment (cm-1)
XNORM  - REAL Vector (Len = Unspecified) - Surface normal vector
HSOLAR - REAL Variable - Spectral solar irradiance (W/cm2/cm-1)
SOLAZ  - REAL Variable - Azimuth angle of incident solar radiation (deg)
SOLEV  - REAL Variable - Elevation angle of incident solar radiation (deg)
HLUNAR - REAL Variable - Spectral lunar irradiance (W/cm2/cm-1)
XLUNAZ - REAL Variable - Azimuth angle of incident lunar radiation (deg)
XLUNEV - REAL Variable - Elevation angle of incident lunar radiation (deg)
HSHINE - REAL Array (Dim = NASMAX x Unspecified) - Skyshine radiance
           (W/cm2/sr/cm-1)
PHISH  - REAL Vector (Len = Unspecified) - Skyshine elevation angles (deg)
NASPCT - INTEGER Variable - Number of skyshine elevation angles
NASMAX - INTEGER Variable - Maximum number of skyshine elevation angles
AZSH   - REAL Vector (Len = Unspecified) - Skyshine azimuth angles (deg)
NAZSH  - INTEGER Variable - Number of skyshine azimuths
TAU    - REAL Variable - Transmittance observer-facet
TAIR   - REAL Variable - Air temperature (K)
PHIRF  - REAL Variable - Elevation angle of reflected line of sight at the
           facet (deg)
AZIM   - REAL Variable - Observer azimuthal angle (deg)
```

PARAMETER Declarations:

```
      INTEGER            NRFMAX
      PARAMETER          (NRFMAX=80)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL               XTERP,PLANCK,BDRF,SHADOW,ROUGH
      COMPLEX            REFEST
      INTRINSIC          SQRT,REAL,DBLE,DPROD,ABS,SIN,COS,MAX,MIN,CMPLX,
                           ATAN2,ACOS,ASIN
      EXTERNAL           XTERP,PLANCK,FRESNL,BDRF,REFEST,DIREMS,PROFAC,
                           ROUGH
```

Local Variable Declarations:

```
      INTEGER            I,K,ITRP0,KEY,KEYP,M,MM,MP,MMM,MMP,NLAYER
      REAL               WL,REFLS,REFLL,RFN,EMIS,PLK,FAC,AZLUN,
                           REFLX,EMV,EMH,TMPLYR(0:3),UOBS(3),USOL(3),
                           ULUN(3),POBS,PSOL,PLUN,XOBS,XSOL,XLUN,AZSOL,
                           SLOPE,SHDWS,SHDWL,XOS,XOL,USHN(3),XSHN,
                           YNORMO,YNORMS,YNORML,FRACSP,DEP(0:3),ZNORM(3)
      DOUBLE PRECISION   EM,RF,RTERS,RTERL,RTERSH,DSNP,DAZSH
      COMPLEX            DIELEC,XMUC,INAIR(2),INMAT(0:2),REFR,EPSX,RH,
                           RV,TV,TH,EPSA
```

COMMON Blocks: /CONSTN/,/MATRLD/

SUBROUTINE CKSTAT

Argument Declarations:

```
  X       - REAL Variable (Output) - Uninitialized variable
  Y       - REAL Variable (Output) - Static/dynamic variable
```

PARAMETER Declarations:

```
      INTEGER           NMAX
      PARAMETER         (NMAX=500)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              ZSTAT
      INTRINSIC         MOD,REAL
      EXTERNAL          ZSTAT
```

Local Variable Declarations:

```
      INTEGER           ICOUNT,KMOD
      REAL              Z(NMAX)
```

COMMON Blocks: None

REAL FUNCTION ZSTAT

Argument Declarations:

```
  I       - INTEGER Variable - Counter
```

Local Variable Declarations:

```
      REAL        ZSTOR
```

COMMON Blocks: None

LOGICAL FUNCTION FLCOL1

Argument Declarations: None

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           IFSCR,II,JJ(5),IOS
```

COMMON Blocks: None

```
                                PROGRAM FPTEST

PARAMETER Declarations:

      INTEGER           MOLMAX
      PARAMETER         (MOLMAX=26)

INTRINSIC and EXTERNAL Declarations:

      INTEGER           LRECHK
      LOGICAL           FLCOL1
      CHARACTER*72      IOERR
      EXTERNAL          CNSTNT,CONFIG,TITLCR,DEVCBD,PROMPT,IOERR,
                          CKSTAT,FLCOL1,LRECHK

Local Variable Declarations:

      INTEGER           I,IOS,NRECL(4)
CIBM  INTEGER           IERR
      REAL              X1,X2,Y1,Y2
      LOGICAL           FLINI,FLSTA
      LOGICAL           FLREC
      CHARACTER*1       DUMMY
      CHARACTER*32      ENDIAN(2),CMPLMT(0:2)
      CHARACTER*33      UNDFL(0:1)
      CHARACTER*47      ROUND(0:2)
      CHARACTER*80      TITLE

COMMON Blocks:          /CONSTN/,/DEVICE/,/MACHIN/
```

INTEGER FUNCTION LRECHK

Argument Declarations: None

```
  NVAR   - INTEGER Variable - Number of variables in record
  NTYPE  - CHARACTER*(*) Variable - Type of variable in record
              1: 'INTEGER' or 'INTEGER*4'
              2: 'INTEGER*1'
              3: 'INTEGER*2'
              4: 'REAL' or 'REAL*4'
              5: 'REAL*8' or 'DOUBLE PRECISION'
              6: 'REAL*16'
              7: 'COMPLEX'
              8: 'COMPLEX*16' or 'DOUBLE COMPLEX'
              9: 'COMPLEX*32'
             10: 'LOGICAL' or 'LOGICAL*4'
             11: 'LOGICAL*1'
             12: 'LOGICAL*2'
             13: 'BYTE'
             14: 'BOOLEAN'
             15: 'CHARACTER'
```

PARAMETER Declarations:

```
      INTEGER           MXLNRC,NLINES
      PARAMETER         (MXLNRC=16384, NLINES=10)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         INT,REAL,DBLE,CMPLX,MOD,CHAR,ICHAR,MAX,AIMAG,
                          LEN
CDBL  INTRINSIC         DCMPLX,DIMAG
CIBM  INTRINSIC         QEXT,QCMPLX,QIMAG
      EXTERNAL          IOERR
```

Local Variable Declarations:

```
      INTEGER           I,J,K,IOS,NRECL,LREC,IFSCR,ITYPE,ICH,NLEN,NCH,
                          JTYPE(20),NBYTES(20),LRECMN,LRECMX
CIBM  INTEGER           IERR,LRECL
CINT1 INTEGER*1         I1(MXLNRC)
      INTEGER*2         I2(MXLNRC)
CINT4 INTEGER*4         I4(MXLNRC)
      REAL              R4(MXLNRC)
CRL4  REAL*4            R4(MXLNRC)
CRL8  REAL*8            R8(MXLNRC)
CIBM  REAL*16           R16(MXLNRC)
      DOUBLE PRECISION  R8(MXLNRC)
      COMPLEX           C8(MXLNRC)
CCM8  COMPLEX*8         C8(MXLNRC)
CCM16 COMPLEX*16        C16(MXLNRC)
      DOUBLE COMPLEX    C16(MXLNRC)
CIBM  COMPLEX*32        C32(MXLNRC)
      LOGICAL           L4(MXLNRC),FL4
      LOGICAL*1         L1(MXLNRC),FL1
CLOG2 LOGICAL*2
CLOG4 LOGICAL*4         L4(MXLNRC),FL4
      CHARACTER*100     CH(MXLNRC)
      BYTE              B1(MXLNRC)
CUNV  BOOLEAN           BL(MXLNRC)
```

COMMON Blocks: None

PROGRAM INSTDB

PARAMETER Declarations:

```
      INTEGER           NTEMP,MLIDMX,MOLMAX
      PARAMETER         (NTEMP=5, MLIDMX=45, MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*1       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         INT,INDEX,LEN,MOD,REAL
CMIL  INTRINSIC         MVBITS
      EXTERNAL          DEVCBD,PROMPT,CONFIG,UPCASE,IOERR,MOLBND,LCTRIM,RDSCN
CIBMV EXTERNAL          FILEINF
```

Local Variable Declarations:

```
      INTEGER           I,J,K,NREC,IFSEQ,IOS,N,NALT,ICKSUM,LAT,LON,
                          NMOLEC,MOLID,NVA,IVA(30),ICHK,IXM,IDUM,IYM
                          IBIN(250),IALF(250),IMOL(250),IPARAM(295),
                          IFREQ(295),IT,IBLK,IBNDWD,IBLOCK,MTEMP,JBK
CINT1 INTEGER*1         IBK(6,6),IWTR(6,6)
      INTEGER*2         IBK(6,6),IWTR(6,6)
      INTEGER*2         IALT(6,6)
CINT  INTEGER           IALT(6,6)
                        IBK(6,6)
                        IWTR(6,6)
CMIL  INTEGER           IFLD(6,6)
CIBMV INTEGER           IERBMD
      REAL              SD(NTEMP),OD(NTEMP),CD(NTEMP),DUM,V,DV,ALF,
                          VA(30),VB(30),CIRR,SNOW,TERR,TSRF(2),
                          CLCV(2,0:3,2),XLAT,XLON,CLDRAD(2,3,2),
                          GMT(2,2),TBAND(NTEMP),SDU(NTEMP,250),
                          ODU(NTEMP,250),ALTIT,FRWTR
      CHARACTER*1       RESPON,YES
      CHARACTER*10      LBMNTH
      CHARACTER*17      MOLNAM(MLIDMX)
      CHARACTER*80      FILENM(12),FILNMS,FILNMG,FILNMU
      CHARACTER*120     NFILE
      LOGICAL           DEFALT,FLXST

COMMON Blocks:          /DEVCNM/,/DEVICE/
```

SUBROUTINE ATMINT

Argument Declarations:

```
  NV     - INTEGER Variable (Input) - Number of spectral records
  IFLTR  - INTEGER Variable (Input) - Filter index
             Refer to User Reference Manual for definition.
  VI     - REAL Variable (Input) - Initial wavenumber (cm-1)
  VF     - REAL Variable (Input) - Final wavenumber (cm-1)
  BW     - REAL Variable (Output) - Effective bandwidth (cm-1)
  BWL    - REAL Variable (Output) - Effective bandwidth (µm)
  NAZ    - INTEGER Vector (Len = Unspecified) (Input) - Number of
             azimuths for each geometry
  NAZSH  - INTEGER Variable (Input) - Number of skyshine azimuths
  NASPCT - INTEGER Vector (Len = Unspecified) (Input) - Number of
             sky/earthshine angles
  NGEOM  - INTEGER Variable (Input) - Number of geometries
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,NASMAX,NZSMAX,NMATL,NGMAX,MOLMAX
      PARAMETER         (NAZMAX=30, NASMAX=15, NZSMAX=4, NMATL=28)
      PARAMETER         (NGMAX=15, MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      REAL              FILTER
      EXTERNAL          FILTER,DEVCBD,IOERR
```

Local Variable Declaration

```
      INTEGER           M,MM,IV,IOS,IGEOM,IG
      REAL              V,DV,FLTR,TAUT(NAZMAX),SIGMET(NAZMAX),
                          TAUSCT(NAZMAX),RADT(NAZMAX),TAUB(NAZMAX),
                          SIGMEB(NAZMAX),TAUSCB(NAZMAX),RADB(NAZMAX),
                          DRADT(NAZMAX),RADSLT(NAZMAX),
                          RADLNT(NAZMAX),DRADB(NAZMAX),
                          RDSLSB(NAZMAX),RDSLST(NAZMAX)
```

COMMON Blocks: /DEVICE/,/INTSTO/,/MOLNMX/

SUBROUTINE ATMOUT

Argument Declarations:

```
  VI     - REAL Vector (Len = Unspecified) (Input) - Initial wavenumber (cm-1)
  VF     - REAL Vector (Len = Unspecified) (Input) - Final wavenumber (cm-1)
  IFLTR  - INTEGER Variable (Input) - Index for filter response
             IFLTR = 0 implies a square wave response
             IFLTR = 1 implies a user-defined response
  TFLTR  - CHARACTER*(*) Variable (Input) - Title for user-defined filter
  ISMARY - INTEGER Variable (Input) - Summary index
```

PARAMETER Declarations:

```
      INTEGER           NGMAX,NAZMAX,NASMAX,MLMAX,NZSMAX,MAXLAT,
                         MAXLON,NVSMAX,ISMX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         ABS
      EXTERNAL          ATMINT,BCKINT,DEVCBD,GETHDR,ATMPRN,BCKPRN,
                          ZROINT,IOERR
```

Local Variable Declarations:

```
      INTEGER           IG,IZ,IOS,IVS,ML0,NVAR(NGMAX)
      REAL              BW,BWL,VIP,VFP,ZL(MLMAX),BWB,BWLB,
                          LATST(MAXLAT),LONST(MAXLON)
      LOGICAL           FLBCKZ
      CHARACTER*40      HEADNG,HEADBK
      CHARACTER*80      TITLE

COMMON Blocks:          /BCKDAT/,/CONSTN/,/DEVICE/,/HEADER/
```

SUBROUTINE BCKINT

Argument Declarations:

```
  NV     - INTEGER Variable (Input) - Number of spectral records
  IFLTR  - INTEGER Variable (Input) - Filter index
             Refer to User Reference Manual for definition.
  VI     - REAL Variable (Input) - Initial wavenumber (cm-1)
  VF     - REAL Variable (Input) - Final wavenumber (cm-1)
  BW     - REAL Variable (Output) - Effective bandwidth (cm-1)
  BWL    - REAL Variable (Output) - Effective bandwidth (µm)
  NAZ    - INTEGER Vector (Len = Unspecified) (Input) - Number of azimuths
  NGEOM  - INTEGER Variable (Input) - Number of geometries
```

PARAMETER Declarations:

```
      INTEGER           NAZMAX,MLMAX,MAXLAT,MAXLON,NGMAX,MOLMAX
      PARAMETER         (NAZMAX=30, MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER         (NGMAX=15, MOLMAX=26)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              FILTER
      CHARACTER*72      IOERR
      EXTERNAL          FILTER,DEVCBD,IOERR
```

Local Variable Declarations:

```
      INTEGER           LB,MM,IV,IOS,IG,IGEOM
      REAL              DV,FLTR,V,SIGMEZ(NAZMAX,MLMAX),
                          TAUSCZ(NAZMAX,MLMAX),RDSCBZ(NAZMAX,MLMAX),
                          RADBZ(NAZMAX,MLMAX),DRADZ(NAZMAX,MLMAX),
                          RDSLBZ(NAZMAX,MLMAX),RDLNBZ(NAZMAX,MLMAX),
                          TAUBZ(NAZMAX,MLMAX)
```

COMMON Blocks: /BCKDAT/,/DEVICE/

SUBROUTINE GETHDR

Argument Declarations:

```
  NFILE  - INTEGER Variable (Input) - Device number
  ITYPE  - INTEGER Variable (Input) - Type of header
  ZBCK   - REAL Vector (Len = Unspecified) (Output) - Altitude grid from the
             background header (km)
  SWBCK  - REAL Array (Dim = MLMAX x Unspecified) (Output) - Switch for
             availability of background data
  TBCK   - REAL Array (Dim = MLMAX x MAXLAT x Unspecified) (Output) -
             Background altitude air temperatures (K)
  NBCKZ  - INTEGER Variable (Output) - Number of background altitudes
  ZL     - REAL Vector (Len = Unspecified) (Output) - Altitude grid (km)
  ML0    - INTEGER Variable (Output) - Number of altitude layers
  NVAR   - INTEGER Vector (Len = NGMAX) (Output) - Number of variables in
             record
  LATST  - REAL Vector (Len = Unspecified) (Input) - Latitude grid (deg)
  LONST  - REAL Vector (Len = Unspecified) (Input) - Longitude grid (deg)
```

PARAMETER Declarations:

```
      INTEGER          NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,MAXLON,ISMX,
                         NVSMAX,MLMAX,MOLMAX
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MLMAX=140)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      EXTERNAL         IOERR
```

Local Variable Declarations:

```
      INTEGER          L,IZ,IOS,KK,LL,NHDR(2),IGEOM
```

COMMON Blocks: /HEADER/

PROGRAM MRFLTR

PARAMETER Declarations:

```
      INTEGER           NGMAX,NAZMAX,NASMAX,MAXLAT,MAXLON,NVSMAX,MLMAX,
                          NXMAX,ISMX,NZSMAX,MOLMAX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MLMAX=140, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20, NXMAX=100)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         MAX,MIN
      EXTERNAL          CNSTNT,ATMOUT,DEVCBD,INITL,RDFLTR,SUMFIL,
                          GETHDR,SETFLG,CONFIG,PROMPT,DBINIT,IOERR
```

Local Variable Declarations:

```
      INTEGER           LENP(NGMAX),ISMARY,ISHINE(NGMAX),NXTRA,IFLTR,
                          NVAR(NGMAX),IOS,JFILE,ISLPOS,IVS,KFILE
      REAL              HXTRA(NXMAX),VI(NVSMAX),VF(NVSMAX),ZBCKZ(MLMAX),
                          LATST(MAXLAT),LONST(MAXLON)
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG,FILERT
      CHARACTER*80      TITLE

COMMON Blocks:          /BCKDAT/,/DEVICE/,/FLAGS/ ,/HEADER/,/INITAL/
```

SUBROUTINE AGUTOL

Argument Declarations:

```
  IAXS   - INTEGER Variable (Input) - Number of the axis
               IAXS = 1 implies the left axis
               IAXS = 2 implies the right axis
               IAXS = 3 implies the bottom axis
               IAXS = 4 implies the top axis
  FUNS   - REAL Variable (Input) - Value of 'AXIS/s/FUNCTION.'
  IDMA   - INTEGER Variable (Input) - Direction of the mapping
  VINP   - REAL Variable (Input) - Value in one coordinate system
  VOTP   - REAL Variable (Output) - Value in other coordinate system
```

CHARACTER*(*) FUNCTION APPEND

Argument Declarations:

```
  STRNG1 - CHARACTER*(*) Variable - Root string
  STRNG2 - CHARACTER*(*) Variable - Additional string
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           LENSTR
      INTRINSIC         LEN,MIN
      EXTERNAL          LENSTR
```

Local Variable Declarations:

```
      INTEGER           IX,IX1,IX2
```

COMMON Blocks: None

BLOCK DATA PLTBD

PARAMETER Declarations:

```
      INTEGER           NSMX,MLIDMX
      PARAMETER         (MLIDMX=45, NSMX=MLIDMX+8)
```

COMMON Blocks: /CHRPRM/,/PLTPRM/

SUBROUTINE PLTDRV

Argument Declarations:

```
  IFATM  - INTEGER Variable (Input) - Atmosphere file number
  IFTRN  - INTEGER Variable (Input) - Transmittance file number
  HEADNG - CHARACTER*(*) Variable (Input) - MOSART file header
  TITLE  - CHARACTER*(*) Variable (Input) - MOSART file title
  NVG    - INTEGER Variable (Input) - Number of spectral points
  IGEOM  - INTEGER Variable (Input) - Geometry index number
  ITYPE  - INTEGER Variable (Input) - X-axis index
             ITYPE = 1 implies wavelength
             ITYPE = 2 implies wavenumber
  ISCALE - INTEGER Variable (Input) - X-axis scale index
             ISCALE = 1 implies linear
             ISCALE = 2 implies logarithmic
  RES    - REAL Variable (Input) - Resolution (cm-1)
  RESWL  - REAL Variable (Input) - Resolution (µm)
  IVS    - INTEGER Variable (Input) - Spectral subset index
```

PARAMETER Declarations:

```
      INTEGER           NUMPTS,NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,
                          MAXLON,ISMX,NVSMAX,NUMCRV,MOLMAX,MLIDMX,NSMX
      PARAMETER         (NUMPTS=3000, NUMCRV=5)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MLIDMX=45, NSMX=MLIDMX+8)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*1       UPCASE
      CHARACTER*72      IOERR
      CHARACTER*100     APPEND
      INTRINSIC         MAX,MIN,INDEX,LEN
      EXTERNAL          IOERR,PROMPT,UPCASE,PLTBD,RDMSRT,APPEND,
                         CHRCBD
      EXTERNAL          EZMXY,AGSETC,AGSETI,AGSETF,AGUTOL
```

Local Variables

```
      INTEGER           K,L,IOS,IX,IBOT,ITOP,ILAB(5),NVGM,MDX
      REAL              ATMINP,RNGLOG
      CHARACTER*1       DOLLAR,RESPON
      CHARACTER*10      PTHTYP(6)
      CHARACTER*46      CHARX
      CHARACTER*79      GEOMNM
      CHARACTER*100     TITLX,HEADNX,ATMNAM,BKGNAM,DUM
```

COMMON Blocks: /CHRCNM/,/CHRPRM/,/HEADER/,/PLTPRM/,/RMODAT/

PROGRAM PLTGEN

PARAMETER Declarations:

```
      INTEGER           MLMAX,NVSMAX,MAXLAT,MAXLON,ISMX,NGMAX,NAZMAX,
                          NASMAX,NZSMAX,MOLMAX
      PARAMETER         (MLMAX=140, NVSMAX=20, MAXLAT=3, MAXLON=1)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*2       UPCASE
      CHARACTER*72      IOERR
      INTRINSIC         INDEX,LEN
      EXTERNAL          PLTDRV,GETHDR,PROMPT,CONFIG,IOERR,UPCASE,LCTRIM
      EXTERNAL          OPNGKS,CLSGKS,AGUTOL
```

Local Variable Declarations:

```
      INTEGER           K,IOS,IFATM,IVS,NBCKZ,ML0,NVAR(NGMAX),IGEOM,
                          IFTRN,ITYPE,ISCALE
      REAL              ZBCKZ(MLMAX),SWBCK(MLMAX,NGMAX),ZL(MLMAX),
                          TBCK(MLMAX,MAXLAT,MAXLON),RES,RESWL,
                          LATST(MAXLAT),LONST(MAXLON)
      LOGICAL           FLXST
      CHARACTER*2       WLN
      CHARACTER*4       SUFFIX,SUFFIT
      CHARACTER*40      HEADNG,FILERT
      CHARACTER*80      TITLE,FILENM
```

COMMON Blocks: /HEADER/

SUBROUTINE RDMSRT

Argument Declarations:

```
  IFATM  - INTEGER Variable (Input) - Atmosphere file unit number
  IFTRN  - INTEGER Variable (Input) - Transmittance file unit number
  NVG    - INTEGER Variable (Input) - Number of spectral points
  ITYPE  - INTEGER Variable (Input) - X-axis index
  MGEOM  - INTEGER Variable (Input) - Number of geometry
  RES    - REAL Variable (Input) - Resolution (cm-1)
  RESWL  - REAL Variable (Input) - Resolution (µm)
  IVS    - INTEGER Variable (Input) - Spectral subset index
```

PARAMETER Declarations:

```
      INTEGER          NAZMAX,NASMAX,MLMAX,NUMPTS,NGMAX,NZSMAX,
                        MAXLAT,MAXLON,ISMX,NVSMAX,NUMCRV,MOLMAX,
                        MLIDMX,NSMX,NDV,NSLTD
      PARAMETER        (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER        (MLMAX=140, MAXLAT=3, MAXLON=1)
      PARAMETER        (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER        (MLIDMX=45, NSMX=MLIDMX+8)
      PARAMETER        (NUMPTS=3000, NUMCRV=5, NVSMAX=20)
      PARAMETER        (NDV=200, NSLTD=3*NAZMAX*(1+ISMX))
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72     IOERR
      INTRINSIC        MAX,MIN,MOD
      EXTERNAL         IOERR,PLTBD,SLITFN
```

Local Variable Declarations:

```
      INTEGER          J,K,M,N,MM,IOS,IG,IGEOM,JP,JJ,MJ,MJM,IS,JMOD,
                         IV,JPM,ISP
      REAL             DVW,SIGMEB,RADT(NAZMAX),DRADT,RADSLT,RESX,V0,
                         RADB(NAZMAX),DRADB,TAUSH,RADSH,RADSE,RADLNT,
                         RADSS,RADSC,RDSLST(NAZMAX),RDSLSB(NAZMAX),
                         RADBE(NAZMAX),RADBR(NAZMAX),RADSD,TAUSCB,
                         DVWL,TAUT(NAZMAX),TM(3,NAZMAX,NSMX),TAUTX,
                         TAUB(NAZMAX),T2,T3,XSLIT(NSLTD),V(NDV),
                         SLIT(NDV,NSLTD),DV(NDV),SUMSLT(NDV)
```

COMMON Blocks: /HEADER/,/PLTPRM/,/RMODAT/

SUBROUTINE COLOR

Argument Declarations:

```
  WL      - REAL Variable (Input) - Wavelength (μm)
  X       - REAL Variable (Output) - First CIE response curve
  Y       - REAL Variable (Output) - Second CIE response curve
  Z       - REAL Variable (Output) - Third CIE response curve
```

PARAMETER Declarations:

```
      INTEGER           MPTS
      PARAMETER         (MPTS=83)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         INT,MAX,MIN,REAL
```

Local Variable Declarations:

```
      INTEGER           M,MP
      REAL              XCIE(MPTS),YCIE(MPTS),ZCIE(MPTS),FAC
```

COMMON Blocks: None

SUBROUTINE HUMAN

Argument Declarations:

```
  V      - REAL Vector (Len = *) (Input) - Wavenumber array (cm-1)
  FILTER - REAL Vector (Len = *) (Output) - Spectral filter (l/w)
  BCKGND - REAL Vector (Len = *) (Input) - Spectral background (W/sr/cm-1)
  NPTS   - INTEGER Variable (Input) - Number of spectral points
  WTLUMN - REAL Variable (Output) - Filter normalization (w/l)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         MAX,MIN,LOG
      REAL              XTERP
      EXTERNAL          XTERP
```

Local Variable Declarations:

```
      INTEGER           I,IV,I1,I2,IVM,IVP
      REAL              WL(45),RESP(45,9),BCKLVL(9),CLPW(9),
                          F1,F2,FAC,DV,DUM,BCKINT(9),WL0,CP,FLTLUX
```

COMMON Blocks: None

SUBROUTINE NRMLZ

Argument Declarations:

X - REAL Variable (Input/Output) - First CIE response curve
Y - REAL Variable (Input/Output) - Second CIE response curve
Z - REAL Variable (Input/Output) - Third CIE response curve

Local Variable Declarations:

REAL SUM

COMMON Blocks: None

SUBROUTINE SUMIT

Argument Declarations:

R - REAL Variable (Input/Output) - Summed value with weight FILTER (xx)
RX - REAL Variable (Input/Output) - Summed value with weight X (xx)
RY - REAL Variable (Input/Output) - Summed value with weight Y (xx)
RZ - REAL Variable (Input/Output) - Summed value with weight Z (xx)
RV - REAL Variable (Input) - Spectral function (xx/cm^{-1})
FILTER - REAL Variable (Input) - Basic filter function
DV - REAL Variable (Input) - Spectral increment (cm^{-1})
X - REAL Variable (Input) - First CIE response curve
Y - REAL Variable (Input) - Second CIE response curve
Z - REAL Variable (Input) - Third CIE response curve

PROGRAM VISUAL

PARAMETER Declarations:

```
      INTEGER           NGMAX,NAZMAX,NASMAX,NZSMAX,NVMAX,MLMAX,
                         MAXLAT,MAXLON,ISMX,NVSMAX,MOLMAX,MLIDMX
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (NVMAX=3600, MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (MLMAX=140, MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MLIDMX=45)
```

INTRINSIC and EXTERNAL Declarations:

```
      CHARACTER*72      IOERR
      INTRINSIC         REAL,DBLE,SQRT,COS,SIN
      EXTERNAL          CNSTNT,DEVCBD,HUMAN,COLOR,SUMFIL,GETHDR,
                         NRMLZ,SUMIT,PROMPT,CONFIG,SETFLG,IOERR,FILRT
```

Local Variable Declarations:

```
      INTEGER           I,K,M,IOS,IG,IV,MM,IVS,NBCKZ,ML0,NVAR(NGMAX),
                          IGP,IGEOM,IDUM
      REAL              V(NVMAX),DV(NVMAX),FILTER(NVMAX),SGMEBT,RADBZ,
                          ZBCK(MLMAX),SWBCK(MLMAX,NGMAX),WL,RADBT,WL1,
                          TAUT(NVMAX,NAZMAX),DRADT(NVMAX,NAZMAX),TAU1,
                          RADSLT(NVMAX,NAZMAX),TAUSCT(NVMAX,NAZMAX),
                          RADLNT(NVMAX,NAZMAX),TAUB(NVMAX,NAZMAX),TAU2,
                          SIGMET(NVMAX,NAZMAX),RADBCK(NVMAX,NAZMAX),
                          RADSH(NASMAX),SIGMEB(NVMAX,NAZMAX),RADBY,WL2,
                          TAUSCB(NVMAX,NAZMAX),TAUSH,X,Y,Z,WTLUMN,RAD1,
                          RADSS(NASMAX,NZSMAX),DRADTT,DRADBT,SGMETT,
                          RADSC(NASMAX,NZSMAX),DRADB(NVMAX,NAZMAX),
                          RADSE(NASMAX,NZSMAX),RADSD(NVMAX,NAZMAX),
                          RDSLST(NVMAX,NAZMAX),RDSLSB(NVMAX,NAZMAX),
                          RADB(NVMAX,NAZMAX),RADBX,RDLNT,RSLSTT,RADBET,
                          RADBE(NVMAX,NAZMAX),RADBR(NVMAX,NAZMAX),DUM,
                          RADT(NVMAX,NAZMAX),RAD2,TASCTT,TASCBT,RDSLT,
                          RADBRT,RSLSBT,RADSDT,BW,BWL,XP(11),YP(11),
                          ZP(11),TBCK(MLMAX,MAXLAT,MAXLON),ZL(MLMAX),
                          LATST(MAXLAT),LONST(MAXLON)
      DOUBLE PRECISION  RE,REPOL,REEQU
      CHARACTER*24      TFLTR
      CHARACTER*40      HEADNG,FILERT
      CHARACTER*45      TLBL(18)
      CHARACTER*80      TITLE,FILENM(14)

COMMON Blocks:          /CONSTN/,/DEVICE/,/FLAGS/ ,/HEADER/,/MOLECP/,
                          /USERNM/
```

PROGRAM FACET

PARAMETER Declarations:

```
      INTEGER           NNMAX,NRMAX,NAZMAX,NASMAX,NGMAX,NZSMAX,MAXLAT,
                          MAXLON,ISMX,NVSMAX,MLMAX,MOLMAX,NRFMAX,
                          NSPCT,NZSH,MLIDMX
      PARAMETER         (NNMAX=3, NRMAX=4, MLMAX=140)
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MAXLAT=3, MAXLON=1, NVSMAX=20)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8, MLIDMX=45)
      PARAMETER         (NRFMAX=80, NSPCT=181, NZSH=361)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GETVAR,SHADOW,FILTER,XTERP,SURFAC
      CHARACTER*3       UPCASE
      CHARACTER*4       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         CMPLX,SQRT,COS,SIN,ACOS,ATAN2,REAL,INT,MAX,MIN,
                          ABS
      EXTERNAL          GETVAR,RDLINE,PARSE,UPCASE,SURFAC,CONFIG,
                          CNSTNT,SHADOW,FILTER,RDFLTR,DEVCBD,INFLBD,
                          LWCASE,XTERP,SETFLG,SUMFIL,GETHDR
```

Local Variable Declarations:

```
      INTEGER           I,K,M,N,NBCKZ,ML0,NVAR(NGMAX),IOS,
                          NN,IGEOM,MM,IV,IVS,IG,NPHI,NTHETA,IP,IT,
                          IFLTR,MINV,NSPCTP,NZSHP,IGRID
      REAL              XNORM(NNMAX),RINDEX,IINDEX,ZBCK(MLMAX),V,DV,
                          SWBCK(MLMAX,NGMAX),SIGNAT(NAZMAX),
                          TBCK(MLMAX,MAXLAT,MAXLON),ZL(MLMAX),A,B,
                          TAUT(NAZMAX),SIGMET(NAZMAX),TAUSCT(NAZMAX),
                          RADT(NAZMAX),RADSLT(NAZMAX),RADLNT(NAZMAX),
                          TAUB(NAZMAX),SIGMEB(NAZMAX),TAUSCB(NAZMAX),
                          RADB(NAZMAX),DRADT(NAZMAX),DRADB(NAZMAX),
                          RDSLST(NAZMAX),RDSLSB(NAZMAX),RADBE(NAZMAX),
                          RADBR(NAZMAX),RADSD(NAZMAX),FLTR,VPM,VPP,
                          TAREA(NGMAX,NAZMAX),BKGD(NGMAX,NAZMAX),UP,VP,
                          TAUSH(NASMAX,NZSMAX),CNTRST,DUMAZ(NZSMAX),
                          RADSH(NASMAX,NZSMAX),SNORM(3),PROJA,TNORM,
                          RADSE(NASMAX,NZSMAX),APPS(NGMAX,NAZMAX),
                          PATH(NGMAX,NAZMAX),DPHI,DTHETA,ASH(NZSH),
                          RADSS(NASMAX,NZSMAX),DAREA,DUM,OBS(3),WL2,
                          RADSC(NASMAX,NZSMAX),RCNTR,PSH(NSPCT),WL1,
                          RADSHN(NSPCT,NZSH),ECCEN,LATST(MAXLAT),
                          RSH(NZSH),PSHI(NASMAX),BW(NGMAX),
                          BWL(NGMAX),RSHM(NASMAX,NZSH),LONST(MAXLON)
      LOGICAL           FLTMP
      CHARACTER*1       DOT,DUMMY
      CHARACTER*24      TFLTR,TFLTR0,TFLTRX,GRID(3),REFT(3),RGH(2)
      CHARACTER*25      SHAPE(4)
      CHARACTER*40      VRDATA(NRMAX),HEADNG,NFFCT
      CHARACTER*80      TITLE
      CHARACTER*255     VARIAB,FILENM,FILNAM
```

```
COMMON Blocks:          /CONSTN/,/DEVICE/,/HEADER/,/MATRLD/,/MOLECP/,
                          /USERNM/
```

REAL FUNCTION ROUGH

Argument Declarations:

```
  HSIGMA - REAL Variable - Standard deviation of the heights on the
             reflective surface
  WL     - REAL Variable - Wavelength (same units as HSIGMA)
  PSI    - REAL Variable - Elevation angle at the surface (deg)
  ITYPE  - INTEGER Variable - Type of surface
             ITYPE = 0 implies a plane wave on a Gaussian distribution
                       of stepped surfaces
             Otherwise, it implies a spherical wave on a Gaussian
                       distribution of sinusoidal surfaces
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              EHBSL0
      INTRINSIC         SIN,EXP
      EXTERNAL          EHBSL0
```

Local Variable Declarations:

```
      REAL              DUM
```

```
COMMON Blocks:          /CONSTN/
```

REAL FUNCTION SURFAC

Argument Declarations:

```
  V      - REAL Variable (Input) - Wavenumber (cm-1)
  DV     - REAL Variable (Input) - Wavenumber increment (cm-1)
  XNORM  - REAL Vector (Len = Unspecified) - Surface normal vector
             vector
  HSOLAR - REAL Variable - Spectral solar irradiance (W/cm2/cm-1)
  SOLAZ  - REAL Variable - Azimuth angle of incident solar radiation (deg)
  SOLEV  - REAL Variable - Elevation angle of incident solar radiation (deg)
             radiation (deg)
  HLUNAR - REAL Variable - Spectral lunar irradiance (W/cm2/cm-1)
  XLUNAZ - REAL Variable - Azimuth angle of incident lunar radiation (deg)
  XLUNEV - REAL Variable - Elevation angle of incident lunar radiation (deg)
  HSHINE - REAL Array (Dim = NASMAX x Unspecified) - Skyshine radiance
             (W/cm2/sr/cm-1)
  PHISH  - REAL Vector (Len = Unspecified) - Skyshine elevation angles (deg)
  NASPCT - INTEGER Variable - Number of skyshine elevation angles
  NASMAX - INTEGER Variable - Maximum number of skyshine elevation angles
  AZSH   - REAL Vector (Len = Unspecified) - Skyshine azimuth angles (deg)
  NAZSH  - INTEGER Variable - Number of skyshine azimuths
  TAU    - REAL Variable - Transmittance observer-facet
  TAIR   - REAL Variable - Air temperature (K)
  PHIRF  - REAL Variable - Elevation angle of reflected line of sight at the
             facet (deg)
  AZIM   - REAL Variable - Observer azimuthal angle (deg)
```

PARAMETER Declarations:

```
      INTEGER           NRFMAX
      PARAMETER         (NRFMAX=80)
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              XTERP,PLANCK,BDRF,SHADOW,ROUGH
      COMPLEX           REFEST
      INTRINSIC         SQRT,REAL,DBLE,DPROD,ABS,SIN,COS,MAX,MIN,CMPLX,
                          ATAN2,ACOS,ASIN
      EXTERNAL          XTERP,PLANCK,FRESNL,BDRF,REFEST,DIREMS,PROFAC,
                          ROUGH
```

Local Variable Declarations:

```
      INTEGER           I,K,ITRP0,KEY,KEYP,M,MM,MP,MMM,MMP,NLAYER
      REAL              WL,REFLS,REFLL,RFN,EMIS,PLK,FAC,AZLUN,
                          REFLX,EMV,EMH,TMPLYR(0:3),UOBS(3),USOL(3),
                          ULUN(3),POBS,PSOL,PLUN,XOBS,XSOL,XLUN,AZSOL,
                          SLOPE,SHDWS,SHDWL,XOS,XOL,USHN(3),XSHN,
                          YNORMO,YNORMS,YNORML,FRACSP,DEP(0:3),ZNORM(3)
      DOUBLE PRECISION  EM,RF,RTERS,RTERL,RTERSH,DSNP,DAZSH
      COMPLEX           DIELEC,XMUC,INAIR(2),INMAT(0:2),REFR,EPSX,RH,
                          RV,TV,TH,EPSA
```

COMMON Blocks: /CONSTN/,/MATRLD/

SUBROUTINE COEFF

Argument Declarations:

```
  BUF    - REAL Array (Dim = NX x Unspecified) (Output) - Array containing
             packed scene Fourier coefficients
  NX     - INTEGER Variable (Input) - Number of pixels in x direction
  NY     - INTEGER Variable (Input) - Number of pixels in y direction
  DX     - REAL Variable (Input) - Resolution in x
  DY     - REAL Variable (Input) - Resolution in y
  K0X    - REAL Variable (Input) - PSD frequency scale in x direction
  K0Y    - REAL Variable (Input) - PSD frequency scale in y direction
  ALPHA  - REAL Variable (Input) - PSD power law index
  VAR    - REAL Variable (Input) - Desired scene variance
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GAUS
      INTRINSIC         SQRT,REAL
      EXTERNAL          GAUS
```

Local Variable Declarations:

```
      INTEGER           I,J,NX2,NY2,NX1,NY1,I1,J1,IP
      REAL              KX,KY,SQT2,RMAXX,RMAXY,RMAX2,DKAPX,DKAPY,
                          PSD2D,STDV,A,B
```

COMMON Blocks: /CONSTN/

REAL FUNCTION CORF

Argument Declarations:

```
  CORL   - REAL Variable - Correlation length
  K0     - REAL Variable - PSD frequency scale
  ALPHA  - REAL Variable - PSD power law index
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              KNU,GAMMA
      EXTERNAL          KNU,GAMMA
```

Local Variable Declarations:

```
      REAL              NU,X
```

COMMON Blocks: None

SUBROUTINE FM2D

Argument Declarations:

```
  X      - REAL Array (Dim = NMAX x Unspecified) (Input/Output) - Scene
             matrix.  It assumed that the y-dimension is at least as
             large as the x-dimension
  N      - INTEGER Variable (Input) - Number of pixels in x direction.
             The scene is assumed to be square
  NMAX   - INTEGER Variable (Input) - Maximum x-dimension of X
  SIGMA  - REAL Variable (Input) - Standard deviation of scene
  H      - REAL Variable (Input) - Sceling parameter defined by H=3-D,
             where D is the fractal dimension
  FLADD  - LOGICAL Variable (Input) - Switch for determining if random
             additions are to be included
```

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GAUS
      EXTERNAL          GAUS
```

Local Variable Declarations:

```
      INTEGER           IX,IY,ND,ND2,MAXLVL,ISTAGE,NM
      REAL              DELTA
```

Statement Function Declarations:

```
      REAL              F3,F4,X0,X1,X2,X3
```

COMMON Blocks: None

SUBROUTINE FOUR1

Argument Declarations:

```
  PDATA  - REAL Vector (Len = Unspecified) (Input/Ouput) - One-dimensional
             complex (i.e., the real and imaginary parts adjacent in
             storage) whose length NN=2**K, K.GE.0 (if necessary append
             zeroes to the data).  Transform values are returned in array
             PDATA, replacing the input.
  NN     - INTEGER Variable (Input) - Length of PDATA
  ISIGN  - INTEGER Variable (Input) - +1 or -1 for finite FFT or its
             inverse.  One of these followed by the other results in
             the original data multiplied by NN.
```

Local Variable Declarations:

```
      INTEGER           I,J,M,N,MMAX,ISTEP
      REAL              TEMPR,TEMPI,THETA,SINTH,WSTPR,WSTPI,WR,WI
```

COMMON Blocks: /CONSTN/

REAL FUNCTION GAMMA

Argument Declarations:

X - REAL Variable - Argument

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              A(5),Y,Y1
```

COMMON Blocks: None

REAL FUNCTION GAUS

Argument Declarations:

STD - REAL Variable - Standard deviation

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          RUNIF
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              T(33),DUM,RAND
```

COMMON Blocks: None

REAL FUNCTION KNU

Argument Declarations:

NU - REAL Variable - Index
X - REAL Variable - Argument

INTRINSIC and EXTERNAL Declarations:

```
      REAL              GAMMA
      INTRINSIC         MAX,REAL,LOG,EXP
      EXTERNAL          GAMMA
```

Local Variable Declarations:

```
      INTEGER           I,N
      REAL              T,T0,DT,SUM,C
```

COMMON Block Declarations: /CONSTN/

SUBROUTINE RUNIF

Argument Declarations:

T - REAL Vector (Len = Unspecified) (Input/Output) - Array of ABS(N)+1 random numbers from a previous invocation of RUNIF. Whenever N is positive and differs from the old N, the table is initialized. The first ABS(N) numbers are the table discussed in the reference, and the (N+1)-st value is Y. This array may be saved in order to restart a sequence.

N - INTEGER Variable (Input) - ABS(N) is the number of random numbers in an auxiliary table. Although ABS(N)+1 is the number of items in array T. If N is positive and differs from its value in the previous invocation, then the table is initialized for the new value of N. If N is negative, ABS(N) is the number of items in an auxiliary table, but the tables are now assumed already to be initialized. This option enables the user to save the table T at the end of a long computer run and to restart with the same sequence. Normally, RUNIF would be called at most once with negative N. Subsequent invocations would have N positive and of the correct magnitude.

X - REAL Variable (Output) - Random number between 0.0 and 1.0.

INTRINSIC and EXTERNAL Declarations:

```
REAL              UNI
INTRINSIC         ABS,INT
EXTERNAL          UNI
```

Local Variable Declarations:

```
INTEGER           I,J,NOLD
REAL              DUMMY
```

COMMON Blocks: None

REAL FUNCTION SCALE

Argument Declarations:

CORL - REAL Variable - Correlation length
ALPHA - REAL Variable - PSD slope

INTRINSIC and EXTERNAL Declarations:

```
REAL              CORF
INTRINSIC         EXP
EXTERNAL          CORF
```

Local Variable Declarations:

```
INTEGER           N
REAL              C,CON,SCMIN,SCMAX,SCL
```

COMMON Blocks: None

```
                                PROGRAM SCNGEN

PARAMETER Declarations:

      INTEGER           NX,NY,NZ,NXP,NYP,NPTS,NXT2,NMATL,NXTILE,NYTILE,
                          NOVRX,NOVRY
      PARAMETER         (NX=1024, NY=NX, NXP=NX+1, NYP=NY+1)
      PARAMETER         (NPTS=NX*NY)
      PARAMETER         (NXTILE=128, NYTILE=NXTILE)
      PARAMETER         (NOVRX=20, NOVRY=NOVRX)
      PARAMETER         (NXT2=2*NX, NZ=1)
      PARAMETER         (NMATL=100)

INTRINSIC and EXTERNAL Declarations:

      INTEGER           IGTINT
      REAL              UNI,SCALE,GETVAR,XTERP
      CHARACTER*1       UPCASE
      CHARACTER*3       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         MAX,MIN,REAL,INT,ABS,SIN,LEN
      EXTERNAL          UNI,SCALE,COEFF,TDFFT,GETVAR,RDLINE,PARSE,FM2D,
                          IGTINT,PROMPT,CONFIG,UPCASE,LWCASE,CNSTNT,
                          IOERR,TILEIT,XTERP

Local Variable Declarations:

      INTEGER           I,IX,IY,IOS,IFSCN,IFINP,IFMSK,NDUM,NCOLM,NROWM,
                          INDX(NMATL),IM,NMAT,IXM,IYM,IFCLD,IXC,IYC,
                          NCP,NROWC,NCOLC,N0,LVAR,NXUSER,NYUSER,NRECL,
                          IROW,NGRID
      REAL              K0X,K0Y,DUM,DX,DY,SEED,SIG,SIGMA,RESMKY,RY,
                          ALPHA(0:NMATL),RESMKX,CMIN,VAR(0:NMATL),SCN,
                          SCNMN(0:NMATL,2),FRACT(NMATL),CMAX,H,PSDPWR,
                          XMIN,XMAX,CUMFRC,DPTS,WTMSK(0:NMATL),CLDCVR,
                          RESCLD,ELEV,CORLEN(0:NMATL),ROW(NX),TRN,
                          RTRAN(NX),RPATH(NX),RSTDV(NX),REFTRN
      LOGICAL           FLADD,MSKADD,CLDADD,FLGRD
      CHARACTER*1       DOT
      CHARACTER*20      VRDATA(8)
      CHARACTER*40      FILENM
      CHARACTER*80      DUMMY
      CHARACTER*255     VARIAB,NFSCN,NFMSK,NFCLD
      CHARACTER*1024    BUFF

COMMON Blocks:          /CONSTN/,/PIXEL/
```

SUBROUTINE TDFFT

Argument Declarations:

```
  BUF    - REAL Array (Dim = NX x Unspecified) (Input/Output) - Upon input,
             BUF is the packed array of scene Fourier coefficients.  Upon
             output, BUF is the random, correlated background fluctuations.
  NX     - INTEGER Variable (Input) - Number of pixels in x direction
  NY     - INTEGER Variable (Input) - Number of pixels in y direction
  ARR    - REAL Vector (Len = Unspecified) - Work space
  UNPCK  - REAL Vector (Len = Unspecified) - Work space
```

INTRINSIC and EXTERNAL Declarations:

```
      EXTERNAL          FOUR1
```

Local Variable Declarations:

```
      INTEGER           I,J,ISGN,NX2,NY2,NSORT,IP,JP,IJ
      REAL              SAVE
```

COMMON Blocks: None

SUBROUTINE TILEIT

Argument Declarations:

```
  X      - REAL Array (Dim = NXMAX x Unspecified) (Output) - Large array
  NX     - INTEGER Variable (Input) - Number of x-elements for X
  NXMAX  - INTEGER Variable (Input) - Maximum number of x-elements for X
  NY     - INTEGER Variable (Input) - Number of y-elements for X
  TILE   - REAL Array (Dim = NTXMAX x Unspecified) (Input) - Small array
  NTX    - INTEGER Variable (Input) - Number of x-elements for TILE
  NTXMAX - INTEGER Variable (Input) - Maximum number of x-elements for TILE
  NTY    - INTEGER Variable (Input) - Number of y-elements for TILE
  NOVRX  - INTEGER Variable (Input) - Number of overlappine elements at the
             edge in the x-direction
  NOVRY  - INTEGER Variable (Input) - Number of overlappine elements at the
             edge in the y-direction
```

INTRINSIC and EXTERNAL Declarations:

```
      INTRINSIC         REAL,MOD
```

Local Variable Declarations:

```
      INTEGER           IX,IY,ITX1,ITX2,ITY1,ITY2
      REAL              FACX,FACY
```

COMMON Blocks: None

REAL FUNCTION UNI

Argument Declarations:

R - REAL Variable - Argument
If R=0., the next random number of the sequence is generated.
If R<0., the last generated number will be returned for possible use in a restart procedure.
If R>0., the sequence of random numbers will start with the seed R mod 1. This seed is also returned as the value of UNI provided the arithmetic is done exactly.

INTRINSIC and EXTERNAL Declarations:

```
INTRINSIC          MOD,INT
```

Local Variable Declarations:

```
INTEGER            IA1,IA0,IA1MA0,IC,IX1,IX0,IY1,IY0
```

COMMON Blocks: None

INTEGER FUNCTION NCHTER

Argument Declarations:

CHVAR - CHARACTER*(*) Variable - Model atmosphere identifier

PARAMETER Declarations:

```
INTEGER            NMATL
PARAMETER          (NMATL=76)
```

INTRINSIC and EXTERNAL Declarations:

```
CHARACTER*10       UPCASE
INTRINSIC          LEN,MIN
EXTERNAL           LCTRIM,UPCASE
```

Local Variable Declarations:

```
INTEGER            I,J,LMAX
CHARACTER*10       CHTER(0:NMATL,2),CHVARP
```

COMMON Blocks: None

SUBROUTINE RDUSRM

Argument Declarations:

```
  IMATL  - INTEGER Variable (Input) - Material index
  IFILE  - INTEGER Variable (Input) - File unit number
  IEND   - INTEGER Variable (Output) - End of file switch
  LABEL  - CHARACTER*(*) Variable (Output) - Material label
  HTALF  - REAL Variable (Output) - Solar absorptivity
  HTEP   - REAL Variable (Output) - Thermal emissivity
  CHRLN  - REAL Variable (Output) - Characteristic length (m)
  IHTFL  - INTEGER Variable (Output) - Heat calculation flag
  SPHT   - REAL Variable (Output) - Specific heat (W-sec/gm/K)
  HCND   - REAL Variable (Output) - Thermal conductivity (W/m/K)
  DNSTY  - REAL Variable (Output) - Density (gm/m3)
  ZLYRR  - REAL Vector (Len = Unspecified) (Output) - Layer thickness (m)
  INLYR  - INTEGER Vector (Len = Unspecified) (Output) - Layer index
```

PARAMETER Declarations:

```
      INTEGER           NMATL,MAXLAT,MAXLON
      PARAMETER         (NMATL=76, MAXLAT=3, MAXLON=1)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           NCHTER
      REAL              GETVAR
      CHARACTER*3       UPCASE
      EXTERNAL          GETVAR,RDLINE,UPCASE,BKGDBD,NCHTER
```

Local Variable Declarations:

```
      INTEGER           MTLDEF
      CHARACTER*255     VARIAB
```

COMMON Blocks: /BACKGD/

PROGRAM TERTEM

PARAMETER Declarations:

```
      INTEGER           NMATL,NTIME,NLAYER,MAXLAT,MAXLON,MOLMAX,NALTMX,
                          MSURF,NGMAX,MLMAX,NSLPMX,NAZMAX,NASMAX,ISMX,
                          NZSMAX,NVSMAX,MLIDMX,NL
      PARAMETER         (NGMAX=15, NAZMAX=30, NASMAX=15, NZSMAX=4)
      PARAMETER         (MOLMAX=26, ISMX=MOLMAX+8)
      PARAMETER         (NVSMAX=20, NMATL=76, NTIME=500, MLMAX=140)
      PARAMETER         (NLAYER=20, NALTMX=11, MSURF=14, NSLPMX=3)
      PARAMETER         (MAXLAT=3, MAXLON=1, MLIDMX=45)
      PARAMETER         (NL=50)
```

INTRINSIC and EXTERNAL Declarations:

```
      INTEGER           IGTINT
      REAL              SEATMP,XTERP,GETVAR,SATUR
      CHARACTER*3       UPCASE
      CHARACTER*4       LWCASE
      CHARACTER*72      IOERR
      INTRINSIC         SIN,MAX,MIN,REAL,ABS,COS,SQRT,MOD
      EXTERNAL          CNSTNT,CONFIG,FILRT,GETHDR,GETVAR,GETVEC,HTBLNC,
                          IGTINT,INTR2D,IOERR,PARSE,EXMLBD,PROFAC,PROMPT,
                          RDLINE,SEATMP,SPCLYR,UPCASE,XTERP,DEVCBD,BKGDBD,
                          CHRCBD,SATUR,ATMSBD,LWCASE,RDUSRM,AECALC
```

Local Variable Declarations:

```
      INTEGER           I,J,K,L,M,MTL,ITM,NSTAB,IOS,KK,LL,IDUM,LY,
                          NBCKZ,ML0,NVAR(NGMAX),NALT,NSLP,NSURF,NTMP,
                          KEYT,KEYTP,NVARMX,NVARX,SCNDX(22),JJ,MTLX,
                          KS,NMTLT,NMTL0,MTIME
      REAL              DECTIM(NTIME),DELTIM,RFDS(NALTMX,NTIME,MSURF),
                          SOLAZT(NTIME),SOLEVT(NTIME),ALT(NALTMX),
                          LTEMP(NTIME),TSRF(NALTMX,NTIME,NMATL,MSURF),
                          TAIRLC(NALTMX,NTIME),STABRS,TSSL(NALTMX),
                          TLYR(10,NTIME),FACTOR(MAXLAT,MAXLON),BSWI,
                          WINDLC(NALTMX,NTIME),PAIRLC(NALTMX,NTIME),
                          TLAYER(0:NLAYER+1),BSW1,BSW2,DTMAX,
                          SPHLYR(0:NLAYER+1),DENLYR(0:NLAYER+1),
                          HTCLYR(0:NLAYER+1),ZLAYER(0:NLAYER+1),BSWF,
                          DUMLYR(2,NLAYER+1),YNORM(3),
                          XNORM(3,MSURF),PLYR(10,NTIME),AZM(4),DSWI,
                          BSWZL(10,NTIME),DSWZL(10,NTIME),DSW1,DSW2,
                          DLWZL(10,NTIME),BSW,DSW(NALTMX,NTIME),DLWI,
                          DLW(NALTMX,NTIME),WNDLYR(10,NTIME),DLWF,DSWF,
                          ZLYR(10),ULWZ(10),DLWZ(10),DLW1,DLW2,SOLAZI,
                          USWZ(10),DSWZ(10),BSWZ(10),FRTEMP(NALTMX),
                          ZBCK(1),SWBCK(MLMAX,1),TBCK(MLMAX,MAXLAT,1),
                          ZL(1),SLOPE(NSLPMX),SOLEVI,SOLAZF,SOLEVF,
                          RFDSI,RFDSF,TAIR1,TAIR2,TAIRI,TAIRF,FACTIM,
                          PAIR1,PAIR2,PAIRI,PAIRF,WIND1,WIND2,WINDI
      REAL              WINDF,ALTX,SLEV,SLAZ,TIMELP,TFINAL,TINIT,
                          TIMEL,SCNCMP(4,NMATL),RHLYR(10,NTIME),
                          TMPCMP(NALTMX,NTIME,MSURF,4),CMOL(MLIDMX),
                          SUMC,RHX,CH2O(10,NTIME)
      LOGICAL           FLSUN,FLINI,FLUSR
      CHARACTER*1       DOT
      CHARACTER*40      HEADNG,FILERT,VRSUB(8)
      CHARACTER*80      TITLE,FILENM(19),FILNM,DUMMY
      CHARACTER*255     VARIAB
```

```
COMMON Blocks:          /ATMDAT/,/BACKGD/,/CHRCNM/,/CONSTN/,/DEVICE/,
                          /EXTMOL/,/HEADER/
```

4.2 Static Variables

All local variables, with the exceptions noted below, are dynamic (except for variables initialized by a DATA statement). All COMMON blocks are SAVEd in each routine in which the COMMON block appears; hence, all variables in COMMON blocks are static.

As stated above, a few local variables are static (via a SAVE statement). These variables and their routines are:

SUBROUTINE ABSMOL:	VDUM, IBIN, IMOL, SDZ, IALF, ODZ, NRECU
SUBROUTINE BMOD:	ISWX, KEYWL, KEYMLP, FAC, TS, TSS, AD0, MLOLD, PRTN0
SUBROUTINE CKSTAT:	ICOUNT
SUBROUTINE CXDTA:	IND
REAL FUNCTION GAUS:	T
SUBROUTINE MIEPHS:	ISWTCH, PCTP
SUBROUTINE MLSCAT:	TAPU, SCTI, SCT3
SUBROUTINE PHFUNC:	WLY, JWL, JWLP, FACWL
SUBROUTINE PHYDRO:	WLY, KWL, KWLP, FACTP
SUBROUTINE PHTOSB:	PLK1, DPLK1
SUBROUTINE RAINSP:	KEYWL
SUBROUTINE RDGBL:	IPRINT
SUBROUTINE RDSCN:	IPRINT
SUBROUTINE RUNIF:	NOLD
SUBROUTINE SETBCK:	ISTORE
SUBROUTINE SNOWSP:	KEYWL
SUBROUTINE STRCNZ:	CN2BCK, VV0

REAL FUNCTION UNI: IX1, IX0

REAL FUNCTION XTERP: KEY

REAL FUNCTION ZODICL: ISW, NORDER, RT, WT

5.0 COMMON BLOCK DATA DICTIONARY

The data dictionary for the COMMON blocks in the MOSART program and related utility codes follow. A brief summary of the COMMON block contents is included, together with a list of routines in which the block occurs. Each variable is listed by name, array size (if applicable), variable type, and a description. See the PARAMETER Data Dictionary for those arrays whose size is defined by a PARAMETER constant.

All COMMON blocks are SAVEd in each routine in which it appears, so all of the variables are static.

AEROSL

This COMMON block contains the aerosol model parameters and the phase functions for the various atmospheric components.

Common Block AEROSL used in:

AERSOL	ARSLBD	BBARSL	BNDPAR	HYDROM	MARINE
PHFUNC	PHYDRO	PRCALC	RSHINE		

Variable Name	Type	Description
WLA(NWLCLD)	REAL	Wavelength (μm)
NRH(30)	INTEGER	Number of relative humidity values
RHP(4,30)	REAL	Relative humidity
ANGLE(NANG)	REAL	Scattering angles (deg)
SCPHA(NANG)	REAL	Aerosol phase function (sr^{-1})
SCPHH(NANG)	REAL	Hydrometer phase function (sr^{-1})
ASYMD(47)	REAL	Asymmetry factor
TMPAMM (4)	REAL	Water cloud temperatures (K)
TMPIMM (4)	REAL	Ice cloud temperatures (K)
NTMP (30)	INTEGER	Number of temperatures used for a cloud

AERSCA

This COMMON block contains the absorption and scattering coefficients for the atmospheric aerosols as a function of wavelength and altitude, together with the keys and proportionality factors for relative humidity.

Common Block AERSCA used in:
AERSOL BBARSL BNDPAR PHFUNC

Variable Name	Type	Description
SCAERO(NWLAER, MLMAX)	REAL	Aerosol scattering coefficient (km^{-1}) as a function of wavelength and altitude
ABAERO(NWLAER, MLMAX)	REAL	Aerosol absorption coefficient (km^{-1}) as a function of wavelength and altitude
JRH(MLMAX)	INTEGER	First index for relative humidity
JRHP(MLMAX)	INTEGER	Second index for relative humidity
FACRH(MLMAX)	REAL	Proportional value between first and second indices

AERSCC

This COMMON block contains the absorption and scattering coefficients as a function of wavelength and altitude.

Common Block AERSCC used in:
BNDPAR HYDROM

Variable Name	Type	Description
ABCLOU(NWLCLD, MLMAX)	REAL	Water cloud absorption coefficient (km^{-1}) as a function of wavelength and altitude
SCCLOU(NWLCLD, MLMAX)	REAL	Water cloud scattering coefficient (km^{-1}) as a function of wavelength and altitude
ABCIRR(NWLCLD, MLMAX)	REAL	Cirrus cloud absorption coefficient (km^{-1}) as a function of wavelength and altitude
SCCIRR(NWLCLD, MLMAX)	REAL	Cirrus cloud scattering coefficient (km^{-1}) as a function of wavelength and altitude
ABCICE(NWLCLD, MLMAX)	REAL	Ice cloud absorption coefficient (km^{-1}) as a function of wavelength and altitude
SCCICE(NWLCLD, MLMAX)	REAL	Ice cloud scattering coefficient (km^{-1}) as a function of wavelength and altitude

AERSLA

This COMMON block contains the aerosol and hydrometeor absorption coefficients.

Common Block AERSLA used in:
AERSOL ARSABD HYDROM MARINE

Variable Name	Type	Description
CA(NWLCLD,30,4)	REAL	Aerosol absorption coefficients (normalized)

AERSLX

This COMMON block contains the aerosol and hydrometeor extinction coefficients.

Common Block AERSLX used in:
AERSOL ARSXBD HYDROM MARINE

Variable Name	Type	Description
CX(NWLCLD,30,4)	REAL	Aerosol extinction coefficients normalized to unity at 0.55 μm

AERUSR

This COMMON block contains the parameters for the user-defined aerosol model.

Common Block AERUSR used in:
AERSOL PHFUNC

Variable Name	Type	Description
GAERO(NWLAER, MLMAX)	REAL	User-defined aerosol asymmetry factor as a function of wavelength and altitude
GUSER(NWLAER)	REAL	User-defined aerosol asymmetry factor corresponding to PHUSER
PHUSER(4,NANG, NWLAER)	REAL	User-defined aerosol phase function (polarization terms included)

ANTECD

This COMMON block contains the 24-hour antecedent parameters for the heat balance calculations.

Common Block ANTECD used in:
BRBNDR DEFALT INITL

Variable Name	Type	Description
NANTE	INTEGER	Number of points
AHR(NANTMX)	REAL	Hour of day (deg.)
ATMP(NANTMX)	REAL	Air temperature (K)
ARH(NANTMX)	REAL	Relative humidity (fraction)
AWND(NANTMX)	REAL	Wind speed (m/sec)
APRS(NANTMX)	REAL	Pressure (mb)
ACLCV(NANTMX,3)	REAL	Low/mid/high etage cloud cover
ACLBS(NANTMX,3)	REAL	Low/mid/high etage cloud base altitude (km)
ACLTP(NANTMX,3)	REAL	Low/mid/high etage cloud top altitude (km)
ISWANT	INTEGER	Antecedent data switch

ARSLSC

This COMMON block contains various parameters used for the aerosol scattering calculations.

Common Block ARSLSC used in:

BNDPAR INICPL MLSCAT PHFUNC PRCALC PTHOSB RSHINE

Variable Name	Type	Description
SCATTR(NANG, MAXLAT,MAXLON, MLMAX)	REAL	Scatter term equal to scatter coefficient times the phase function divided by 4*PI (km^{-1} sr^{-1})
SCTVAR(NANG, MAXLAT,MAXLON, MLMAX)	REAL	
ASYM(MLMAX, MAXLAT,MAXLON)	REAL	Combined asymmetry factor
ASYMA(MLMAX, MAXLAT,MAXLON)	REAL	Aerosol asymmetry factor
SCATOT(MLMAX, MAXLAT,MAXLON)	REAL	Combined scattering coefficient (km^{-1})

ATMDAT

This COMMON block contains the model atmosphere parameters.

Common Block ATMDAT used in:

ATMPRN	ATMSBD	BCKPRN	BRBNDR	CALCUL	CIRRUS
DFLT2	EQABS	EQUABS	INITL	PRCALC	SCNRIO
SETALT	SETBCK	SHNGEO	SRCGEO	SRCIRR	USRDEF

Variable Name	Type	Description
REBAR	DOUBLE PRECISION	Mean radius of the earth (km)
REPOL	DOUBLE PRECISION	Polar radius of the earth (km)
REEQU	DOUBLE PRECISION	Equatorial radius of the earth (km)
Z(NL)	REAL	Altitude (km)
P(NL,24)	REAL	Pressure (mb)
T(NL,24)	REAL	Temperature (K)
LATIT(24)	REAL	Latitude (deg)
WINDEF(24)	REAL	Effective wind speed (m/sec)
LATST(MAXLAT)	REAL	Storage for model atmosphere latitude (deg)
LATST(MAXLON)	REAL	Storage for model atmosphere longitude (deg)

BACKGD

This COMMON block contains the material reflectivity and temperature parameters and the scene composition parameters.

Common Block BACKGD used in:

ATMPRN BCKGND BKGDBD BRBNDR COUPLE GETBCK
INITL SETBCK SPCLYR USRBCK

Variable Name	Type	Description
NWLBK(NMATL)	INTEGER	Number of wavelengths
WLBKGD(90,NMATL)	REAL	Wavelength (μm)
NMATRL	INTEGER	Number of materials
REFLEC(90,NMATL)	REAL	Hemispherical average reflectivity
IBKTYP(NMATL)	INTEGER	Background reflection index
FRDIF(NMATL)	REAL	Fraction of background reflection that is diffuse
BKRGH(NMATL)	REAL	Roughness standard deviation (m)
CORREL(NMATL)	REAL	Roughness correlation length (m)
IRGH(NMATL)	INTEGER	Roughness index
FINC(NMATL)	REAL	Fraction of air mixed with material
ITINC(NMATL)	INTEGER	Type of inclusion
KMATL	INTEGER	Number of materials in scene
INDEXB(NMATL)	INTEGER	Material index
FRACT(NMATL)	REAL	Fraction of material defined by INDEX in scene
TEMPM(NAMTL,6 MAXLAT,MAXLON)	REAL	Temperature (K) of each material in sun light and in shade
IHTFLG(NMATL)	INTEGER	Heat balance calculation index
HTALPH(NMATL)	REAL	Solar absorptivity
HTEPS(NMATL)	REAL	Thermal emissivity
HTCOND(NMATL)	REAL	Conduction coefficient ($W/m^2/K$)
CHARLN(NMATL)	REAL	Convective characteristic length (m)
SPHEAT(NMATL)	REAL	Specific heat (W-sec/gm/K)
DENSTY(NMATL)	REAL	Density (gm/m^3)
STDVSC(NMATL)	REAL	Standard deviation of the material defined by INDEX divided by the mean

ZHLYR(2,NMATL)	REAL	Layer thickness (m)
NWLUSR	INTEGER	Number of spectral points for user-defined materials
WLUSR(100)	REAL	Wavelength (μm)
REFUSR(100,3) REAL		User-defined diffuse reflectivity
WAVEHT(MAXLAT, MAXLON)	REAL	Sea wave height (m)
SLOPEW(MAXLAT, MAXLON)	REAL	Sea rms wave slope
FOAM(MAXLAT, MAXLON)	REAL	Fraction of foam
INDLYR(3,NMATL)	INTEGER	Indices of layers

BCKDAT

This COMMON block contains the parameters for the paths to each ba background altitude.

Common Block BCKDAT used in:

BCKPRN EQUABS INTEG KDISTR PRCALC PUTHDR
SCNRIO ZROINT ATMOUT BCKINT MRFLTR

Variable Name	Type	Description
NBCKZ	INTEGER	Number of background altitudes
LBCKXX(MLMAX)	INTEGER	Background altitude indices
ZBCK(MLMAX)	REAL	Altitude (km)
TAUBZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of transmission at altitude
RADBZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of thermal path radiance to background ($W/cm^2/sr$)
RSLBZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of Apparent solar irradiance at background (W/cm^2)
RLNBZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of apparent lunar irradiance at background (W/cm^2)
RSCBZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of scattered path radiance to background ($W/cm^2/sr$)
RADSHB(NAZMAX, MLMAX)	REAL	Upper thermal skyshine irradiance at background ($W/cm^2/cm^{-1}$)
RDSHBT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of upper thermal skyshine irradiance at background (W/cm^2)

RDSHSB(NAZMAX, MLMAX)	REAL	Upper scattered skyshine irradiance at background ($W/cm^2/cm^{-1}$)
RSHSBT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of upper scattered skyshine irradiance at background (W/cm^2)
SGMEZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of scintillation at background
TASCZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of in-scattered transmittance
DRADZT(NAZMAX, MLMAX,NGMAX)	REAL	Running integral of standard deviation of the thermal path radiance
SWBCK(MLMAX, NGMAX)	REAL	Switch for availability of background parameters
TBCK(MLMAX, MAXLAT,MAXLON)	REAL	Temperature at background (K)
LZ(MLMAX,NGMAX)	INTEGER	Altitude indices

BRBNDT

This COMMON block contains the altitude and time dependent heat fluxes.

Common Block BRBNDT used in:
BRBNDR SRCFLX

Variable Name	Type	Description
ZLYR(10)	REAL	Altitude (km)
TLBR(101)	REAL	Temperature (K)
PLBR(101)	REAL	Pressure (mb)
RHLYER(10,NTIME)	REAL	Relative humidity
ULWZ(10,NTIME)	REAL	Upward long-wave flux (W/m^2)
DLWZ(10,NTIME)	REAL	Downward long-wave flux (W/m^2)
USWZ(10,NTIME)	REAL	Upward short-wave flux (W/m^2)
DSWZ(10,NTIME)	REAL	Downward short-wave flux (W/m^2)
BSWZ(10,NTIME)	REAL	Beam short-wave flux (W/m^2)

BSTAER

This COMMON block contains the parameters for the temperature dependent background stratospheric aerosol model.

Common Block BSTAER used in:
AERSOL BKSTBD PHFUNC

Variable Name	Type	Description
IWL(NWLAER)	INTEGER	Key relating the other aerosol wavelength array to WLBST
WLBST(68)	REAL	Wavelength (μm)
STATMP(NSTTMP)	REAL	Temperature (K)
STMPSC (NSTTMP,68)	REAL	Normalized scattering coefficient
STMPAB (NSTTMP,68)	REAL	Normalized absorption coefficient
STMPSY (NSTTMP,68)	REAL	Asymmetry factor

CDRYDS

This COMMON block contains the user-defined model name.

Common Block CDRYDS used in:
DIREMS EMISBD

Variable Name	Type	Description
FRAC(2,0:NLMAX,6)	REAL	Layer fraction volume
DEP(0:NLMAX,6)	REAL	Layer depth (m)

CFCBM

This COMMON block contains the cross-sections for the chloro-fluorocarbons.

Common Block CFCBM used in:
ABSCFC CFCBD

Variable Name	Type	Description
N11	INTEGER	Number of spectral bins for CFC-11
NV11(2)	INTEGER	Number of spectral points in each bin
V11(2,2)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC11(5,75)	REAL	Cross-sections for CFC-11 ($molecules^{-1}$ cm^2)
N12	INTEGER	Number of spectral bins for CFC-12
NV12(2)	INTEGER	Number of spectral points in each bin
V12(2,2)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC12(5,165)	REAL	Cross-sections for CFC-12 ($molecules^{-1}$ cm^2)
N13	INTEGER	Number of spectral bins for CFC-13
NV13(3)	INTEGER	Number of spectral points in each bin
V13(2,3)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC13(5,177)	REAL	Cross-sections for CFC-13 ($molecules^{-1}$ cm^2)
N14	INTEGER	Number of spectral bins for CFC-14
NV14(1)	INTEGER	Number of spectral points in each bin
V14(2,1)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC14(5,34)	REAL	Cross-sections for CFC-14 ($molecules^{-1}$ cm^2)

CFCBM (continued)

N21	INTEGER	Number of spectral bins for CFC-21
NV21(3)	INTEGER	Number of spectral points in each bin
V21(2,3)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC21(5,172)	REAL	Cross-sections for CFC-21 ($molecules^{-1}$ cm^2)
N22	INTEGER	Number of spectral bins for CFC-22
NV22(3)	INTEGER	Number of spectral points in each bin
V22(2,3)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC22(5,172)	REAL	Cross-sections for CFC-22 ($molecules^{-1}$ cm^2)
N113	INTEGER	Number of spectral bins for CFC-113
NV113(2)	INTEGER	Number of spectral points in each bin
V113(2,2)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC113(5,440)	REAL	Cross-sections for CFC-113 ($molecules^{-1}$ cm^2)
N114	INTEGER	Number of spectral bins for CFC-114
NV114(4)	INTEGER	Number of spectral points in each bin
V114(2,4)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC114(5,358)	REAL	Cross-sections for CFC-114 ($molecules^{-1}$ cm^2)
N115	INTEGER	Number of spectral bins for CFC-115
NV115(3)	INTEGER	Number of spectral points in each bin
V115(2,3)	REAL	Beginning and ending values for each bin (cm^{-1})
CFC115(5,186)	REAL	Cross-sections for CFC-115 ($molecules^{-1}$ cm^2)

CGWTS

This COMMON block contains the summing weights for the Curtis-Godson approximation.

Common Block CGWTS used in:
BNDPAR PTHTAU

Variable Name	Type	Description
CGWT1(ISMX, MLMAX,MAXLAT, MAXLON)	REAL	Curtis-Godson summing weight for S1
CGWT2(ISMX, MLMAX,MAXLAT, MAXLON)	REAL	Curtis-Godson summing weight for S2
CGWT3(ISMX, MLMAX,MAXLAT, MAXLON)	REAL	Curtis-Godson summing weight for S3
CGWT4(ISMX, MLMAX,MAXLAT, MAXLON)	REAL	Curtis-Godson summing weight for S6

CHRCNM

This COMMON block contains the miscellaneous CHARACTER strings used in output files.

Common Block CHRCNM used in:

ATMPRN BRBNDR CHRCBD EQUABS PUTCLD SUMFIL
USRBCK MENU PLTDRV

Variable Name	Type	Description
TAERO(19)	CHARACTER*50	Aerosol titles
TITAER(19)	CHARACTER*10	Aerosol abbreviated titles
TTYPE(24)	CHARACTER*50	Model atmosphere titles
THAZE(9,2)	CHARACTER*50	Haze profile titles
TUPPER(2)	CHARACTER*50	Upper atmosphere titles
TITBKD(-4:118)	CHARACTER*10	Abbreviated background titles
RNTYPE(5)	CHARACTER*40	Rain model titles
CLDRNM(22)	CHARACTER*60	Cloud/fog/rain titles
CLDABR(22)	CHARACTER*8	Abbreviated cloud titles
SNTYPE(6)	CHARACTER*26	Snow model titles
TITBKG(-4:118)	CHARACTER*60	Background titles

CHRPRM

This COMMON block contains the miscellaneous CHARACTER strings used in the plotting package.

Common Block CHRPRM used in:
PLTBD PLTDRV

Variable Name	Type	Description
TLABEL(5)	CHARACTER*50	Plot labels
XLAB	CHARACTER*42	X-axis label
MOLNAM(NSMX)	CHARACTER*18	Molecular name

CLDPAR

This COMMON block contains the parameters for determining the impact of clouds on the broad band heat fluxes.

Common Block CLDPAR used in:
BRBNBD CLDLYR FLUXLW

Variable Name	Type	Description
TLC	REAL	Low etage cloud optical depth
GLC	REAL	Low etage cloud asymmetry factor
EL	REAL	Low etage cloud emissivity
TMC	REAL	Middle etage cloud optical depth
GMC	REAL	Middle etage cloud asymmetry factor
EM	REAL	Middle etage cloud emissivity
THC	REAL	High etage cloud optical depth
GHC	REAL	High etage cloud asymmetry factor
EH	REAL	High etage cloud emissivity

CLDRN

This COMMON block contains the parameters for altitude dependent cloud/fog/rain/snow conditions.

Common Block CLDRN used in:

CLDRBD ENDPT EQUABS GETCLD HYDROM PUTCLD
RAINSP TANGPT USRCLD

Variable Name	Type	Description
ZCLD(21)	REAL	Altitude (km)
CLDEQ(21,15)	REAL	Liquid water content (gm/m^3)
XLWC(15)	REAL	Conversion from liquid water content to extinction at 0.55 μm ($km^{-1}/(gm/m^3)$)
RNRT(21,15)	REAL	Rain rate (mm/hr)
NCLD(5)	INTEGER	Cloud index for a given rain model
NZCLD	INTEGER	Number of altitude points in profile
NRNTYP(5)	INTEGER	Rain index
NZUCLD	INTEGER	Number of user-defined altitudes
ZUCLD(25)	REAL	User-defined altitude (km)
CLDEQU(25)	REAL	User-defined liquid water content (gm/m^3)
XLWCU	REAL	Conversion from liquid water content to extinction at 0.55 μm for user-defined cloud ($km^{-1}/(gm/m^3)$)
CLDICU(25)	REAL	User defined ice content (gm/m^3)
XICEU	REAL	Conversion from ice content to extinction at 0.55 μm for user-defined cloud ($km^{-1}/(gm/m^3)$)
RNRTU(25)	REAL	User-defined rain rate (mm/hr)
NRNTYU	INTEGER	User-defined rain index
SNRTU(25)	REAL	User-defined snow rate (mm/hr)
NSNTYU	INTEGER	User-defined snow index
CLDBS(16)	REAL	Cloud base altitude (km)
CLDTP(16)	REAL	Cloud top altitude (km)
NAERCL(16)	INTEGER	Aerosol index for cloud model

CLDUSR

This COMMON block contains the parameters for a user-defined cloud/rain/snow model.

Common Block CLDUSR used in:
BNDPAR HYDROM PHYDRO USRCLD

Variable Name	Type	Description
NWLCLU	INTEGER	Number of spectral points
WLCLU(100)	REAL	Wavelength (μm)
SLWCU(100)	REAL	Normalized scatter coefficient for water
ALWCU(100)	REAL	Normalized absorption coefficient for water
GLWCU(100)	REAL	Asymmetry factor for water
SICEU(100)	REAL	Normalized scatter coefficient for ice
AICEU(100)	REAL	Normalized absorption coefficient for water
GICEU(100)	REAL	Asymmetry factor for ice

CLIMAT

This COMMON block contains the layer indices for the broad band heat flux calculations.

Common Block CLIMAT used in:
FLUXLW OPATH PRETEM SRAT

Variable Name	Type	Description
IALAY(10)	INTEGER	Altitude index for each layer

CO2PAR

This COMMON block contains the LOWTRAN band parameters for carbon dioxide.

Common Block CO2PAR used in:
LOWTRN UMIXBD

Variable Name	Type	Description
CPCO2(1219)	REAL	LOWTRAN band model parameters for carbon dioxide

CONSTN

This COMMON block contains the basic constants used throughout the program.

Common Block CONSTN used in:

ABSMOL	AIRTMP	AMOLSC	ASPECT	ATMPRN	BAND
BCKGND	BCKPRN	BDRF	BETA	BETAU	BMOD
BNDPAR	BRBNDR	CNSTNT	COAT	COMFNC	COUPLE
CSPHFN	DBINIT	DESAER	DFLT2	DFLT8	DIREMS
DNDR	DPLDT	ECLGAL	ENDPT	EPHEML	EPHEMS
EQABS	EQUABS	EQUECL	ESFIT	EXGALS	FILTER
FRESNL	GALRAD	GEOM	GETSLR	HOREQU	HORIZN
HTBLNC	INICPL	INIGEO	INITL	LYRINT	MARINE
MIE	MIEPHS	MLSCAT	MODBCK	PHFUNC	PHYDRO
PLANCK	PLANET	PRCALC	PRETEM	PROFAC	PTHOSB
PTHTAU	RADTRX	RADTRY	RAINEX	REFEST	RSHINE
SATUR	SCINTL	SCNRIO	SETALT	SETUP	SHADOW
SHNGEO	SKYNOI	SLPOS	SLUNAR	SNOWEX	SPCLYR
SPTRIG	SRCGEO	SRCIRR	STARAD	STGEOM	STRCN2
SUPK	TERMPR	UDLAY	USRDEF	XTERP	ZLAT
ZODICL	BBTEMP	INVPLK	FPTEST	ATMOUT	VISUAL

Variable Name	Type	Description
DPI	DOUBLE PRECISION	3.1415926358979
DRAD	DOUBLE PRECISION	Pi/180 for conversion of degrees to radians
DE	DOUBLE PRECISION	2.71828182845904
DEPSMN	DOUBLE PRECISION	Smallest normalized positive number
DEPSMX	DOUBLE PRECISION	Largest normalized positive number
DEPSDF(2)	DOUBLE PRECISION	Smallest value that can be significantly added (1) or subtracted (2) from unity
DEPSDN	DOUBLE PRECISION	Smallest denormalized positive number
PI	REAL	3.14159
RAD	REAL	Pi/180 for conversion of degrees to radians

E	REAL	2.71828
EPSMIN	REAL	Smallest normalized positive number
EPSMAX	REAL	Largest normalized positive number
EPSDIF(2)	REAL	Smallest value that can be significantly added (1) or subtracted (2) from unity
EPSDNM	REAL	Smallest denormalized positive number
IRADIX	INTEGER	Radix; basic unit of calculation
ITR	INTEGER	Number of bits in REAL significand
ITD	INTEGER	Number of bits in DOUBLE PRECISION significand
IRND	INTEGER	Addition rounding switch
NGRD	INTEGER	Number of guard digits
MACHEP	INTEGER	Smallest exponent for 1+e (REAL)
NEGEP	INTEGER	Smallest exponent for 1-e (REAL)
MACHED	INTEGER	Smallest exponent for 1+e (DOUBLE PRECISION)
NEGEPD	INTEGER	Smallest exponent for 1-e (DOUBLE PRECISION)
MINEXP	INTEGER	Minimum REAL exponent
MAXEXP	INTEGER	Maximum REAL exponent
MINEXD	INTEGER	Minimum DOUBLE PRECISION exponent
MAXEXD	INTEGER	Maximum DOUBLE PRECISION exponent
IEXPR	INTEGER	Number of bits in REAL exponent
IEXPD	INTEGER	Number of bits in DOUBLE PRECISION exponent
IUNDFL	INTEGER	Gradual/abrupt underflow switch
ICMLMT	INTEGER	One's/two's/signed complement switch
IEND	INTEGER	Big/little-endian switch
IREG	INTEGER	Register vs. storage calculation switch

CONTNS

This COMMON block contains the parameters for the self- and foreign-broadened water vapor continuum.

Common Block CONTNS used in:
H2OBD H2OCNT

Variable Name	Type	Description
VS1	REAL	Initial wavenumber (cm^{-1})
VS2	REAL	Final wavenumber (cm^{-1})
DVS	REAL	Wavenumber increment (cm^{-1})
NPTSC	INTEGER	Number of spectral points
TEMP(2)	REAL	Temperature (K)
SBAC(-1:2001,2)	REAL	Temperature dependent self-broadened continuum ($amagat^{-1}$ cm^{-1})
FBAC(-1:2001)	REAL	Foreign broadened continuum ($amagat^{-1}$ cm^{-1})

CRASYM

This COMMON block contains the asymmetry factors for the standard, sub-visual, and Heymsfield cirrus cloud models.

Common Block CRASYM used in:
CIRRBD PHYDRO

Variable Name	Type	Description
CIRASY (NWLCLD,4,3)	REAL	Asymmetry factors

CURGDA

This COMMON block contains the Curtis-Godson summing variables for correlation calculations.

Common Block CURGDA used in:
PRCALC PTHTAU RSHINE

Variable Name	Type	Description
S1S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for Lorentz half-width times the line density
S2S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for Doppler half-width times the line density

CURGDB

This COMMON block contains the Curtis-Godson summing variables for correlation calculations.

Common Block CURGDB used in:
PRCALC PTHTAU RSHINE

Variable Name	Type	Description
S3S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for line density (cm)
S4S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for the continuum optical depth

CURGDC

This COMMON block contains the Curtis-Godson summing variables for correlation calculations.

Common Block CURGDC used in:
PRCALC PTHOSB PTHTAU RSHINE

Variable Name	Type	Description
S5S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for scattering optical depth
S6S(ISMX,MLMX2)	REAL	Intermediate values of the summing variable for the square of the Lorentz half-width

DESDAT

This COMMON block contains the parameters for the desert aerosol model.

Common Block DESDAT used in:
DESAER DSRTBD

Variable Name	Type	Description
DESEX(NWLAER,4)	REAL	Normalized extinction coefficient equal to unity at 0.55 μm
DESAB(NWLAER,4)	REAL	Normalized absorption coefficient
DESG(NWLAER,4)	REAL	Asymmetry factor

DEVCNM

This COMMON block contains the CHARACTER strings for the binary data bases used by the code.

Common Block DEVCNM used in:

DBINIT DEVCBD FILRT RDGBL RDSCN SUMFIL
ASCBIN INSTDB

Variable Name	Type	Description
NFBMD(MOLMAX)	CHARACTER*60	File names of the direct access binary data base files
SUFFIX(18)	CHARACTER*10	Suffixes for all input and output files
NFGBL	CHARACTER*60	File name for global climatology data base
NFSCN	CHARACTER*60	File name for terrain scene and altitude data base
NFVFT	CHARACTER*60	File name for MODTRAN band parameter data base
DIRPTH	CHARACTER*60	Data base directory path

DEVICE

This COMMON block contains the file unit numbers used by the code.

Common Block DEVICE used in:

ABSMOL	ATMPRN	BCKPRN	BRBNDR	CALCUL	DBINIT
DEFALT	DEVCBD	DFLT8	EQUABS	FLSTAT	GETASP
GETATM	GETBCK	GETCLD	GETPOS	GETSLR	INITL
MIEINP	MOSART	PRCALC	PUTCLD	PUTHDR	PUTSLR
RDFLTR	RDGBL	RDSCN	SUMFIL	USRBCK	USRCLD
ASCBIN	BBTEMP	CRFILE	FPTEST	INSTDB	
ATMINT	ATMOUT	BCKINT	MRFLTR	VISUAL	

Variable Name	Type	Description
IFINP	INTEGER	Input file number
IFOUT	INTEGER	Output file number
IFATM	INTEGER	Atmospheric binary file number
IFBCK	INTEGER	Background binary file number
IFPLM	INTEGER	Plume binary file number
IFMSC	INTEGER	Multiple scatter binary file number
IFHTR	INTEGER	Heat transfer binary file number
IFTRN	INTEGER	Transmittance binary file number
IFUAT	INTEGER	User-defined atmosphere file number
IFUBK	INTEGER	User-defined background file number
IFUCL	INTEGER	User-defined cloud file number
IFUAR	INTEGER	User-defined aerosol file number
IFASC	INTEGER	ASCII conversion file number
IFTBL	INTEGER	Tabular file number
IFFLT	INTEGER	Filter response file number
IFTP7	INTEGER	LOWTRAN TAPE7 file number
IFTP8	INTEGER	LOWTRAN TAPE8 file number
IFDIS	INTEGER	DIS in-band file number
IFBMD(MOLMAX)	INTEGER	Molecular data base file numbers
IFVFT	INTEGER	MODTRAN band parameter file number
IFGBL	INTEGER	Global data base file number
IFSCN	INTEGER	Scene data base file number
IFSCR	INTEGER	Scratch file number
IFGEO	INTEGER	Geometry scratch file number

IRECL(MOLMAX)	INTEGER	Molecular data base record lengths
IRECLU	INTEGER	MODTRAN band parameter data base record length
IRECLG	INTEGER	Global data base record length
IRECLS	INTEGER	Scene data base record length
NVRMAX(MOLMAX)	INTEGER	Number of records for molecular data bases
NVRMXU	INTEGER	Number of records for MODTRAN band parameter data base
NVRMXG	INTEGER	Number of records for global data base
NVRMXS	INTEGER	Number of records for scene data base
FLBMD(MOLMAX)	LOGICAL	Flag for existence of separate molecular data base file

EXTMOL

This COMMON block contains the trace gas altitude profiles.

Common Block EXTMOL used in:
EQABS EXMLBD USRDEF

Variable Name	Type	Description
BMOL(NL,38)	REAL	Trace gas concentration profiles (ppmv)

FLAGS

This COMMON block contains various flags to control certain calculations.

Common Block FLAGS used in:

ATMPRN	BCKCHK	BCKPRN	BINFIL	CALCUL	EPHEMS
EQABS	HAZE	INITL	ISRAEL	MOSART	PRCALC
PUTSLR	RSHINE	SCNRIO	SETFLG	SRCIRR	SUMFIL
TERMPR	BBTEMP	MRFLTR	VISUAL		

Variable Name	Type	Description
FLSLR	LOGICAL	Solar calculation flag
FLLNR	LOGICAL	Lunar calculation flag
FLEPH	LOGICAL	Ephemeris calculation flag
FLSMP	LOGICAL	Solar simple calculation flag
FLSML	LOGICAL	Lunar simple calculation flag
FLVSA	LOGICAL	Vertical structure algorithm calculation flag
FLATM	LOGICAL	Atmospheric file existence flag
FLBCK	LOGICAL	Background file existence flag
FLFBA	LOGICAL	Fore/background flag
FLSRC(NGMAX)	LOGICAL	Source geometry flag
FLCNT(NGMAX)	LOGICAL	Combined (contrast) geometry flag
FLASR(NGMAX)	LOGICAL	At-source geometry flag
FLHOR(NGMAX)	LOGICAL	Horizontal path geometry flag
FLIMB(NGMAX)	LOGICAL	Earthlimb geometry flag
FLMSC	LOGICAL	Multiple scattering flag

FLTRDT

This COMMON block contains the filter response parameters.

Common Block FLTRDT used in:
FILTER MOSART RDFLTR BBTEMP MRFLTR

Variable Name	Type	Description
NFLTR	INTEGER	Number of spectral points in filter response function
WLF(1200)	REAL	Wavelength (μm)
FLTR(1200)	REAL	Spectral filter response function

FLXTAB

This COMMON block contains various parameters for the broad band heat flux taken from Staley and Jurica.

Common Block FLXTAB used in:
BRBNBD TRANLW

Variable Name	Type	Description
UTAB(21,4)	REAL	Unknown parameter for water vapor
VTAB(23,4)	REAL	Unknown parameter for carbon dioxide
WTAB(16,4)	REAL	Unknown parameter for ozone
OPR(23,3)	REAL	Unknown parameter
TR(4)	REAL	Unknown parameter
IR(3)	INTEGER	Unknown parameter

GAUSSL

This COMMON block contains the Gauss-Legendre coefficients.

Common Block GAUSSL used in:
GETGLC GLCFBD

Variable Name	Type	Description
XMU2(1)	DOUBLE PRECISION	2-point Gauss-Legendre abscissa
WT2(1)	DOUBLE PRECISION	2-point Gauss-Legendre weights
XMU3(2)	DOUBLE PRECISION	3-point Gauss-Legendre abscissa
WT3(2)	DOUBLE PRECISION	3-point Gauss-Legendre weights
XMU4(2)	DOUBLE PRECISION	4-point Gauss-Legendre abscissa
WT4(2)	DOUBLE PRECISION	4-point Gauss-Legendre weights
XMU5(3)	DOUBLE PRECISION	5-point Gauss-Legendre abscissa
WT5(3)	DOUBLE PRECISION	5-point Gauss-Legendre weights
XMU6(3)	DOUBLE PRECISION	6-point Gauss-Legendre abscissa
WT6(3)	DOUBLE PRECISION	6-point Gauss-Legendre weights
XMU7(4)	DOUBLE PRECISION	7-point Gauss-Legendre abscissa
WT7(4)	DOUBLE PRECISION	7-point Gauss-Legendre weights
XMU8(4)	DOUBLE PRECISION	8-point Gauss-Legendre abscissa
WT8(4)	DOUBLE PRECISION	8-point Gauss-Legendre weights
XMU9(5)	DOUBLE PRECISION	9-point Gauss-Legendre abscissa
WT9(5)	DOUBLE PRECISION	9-point Gauss-Legendre weights
XMU10(5)	DOUBLE PRECISION	10-point Gauss-Legendre abscissa
WT10(5)	DOUBLE PRECISION	10-point Gauss-Legendre weights
XMU12(6)	DOUBLE PRECISION	12-point Gauss-Legendre abscissa
WT12(6)	DOUBLE PRECISION	12-point Gauss-Legendre weights
XMU16(8)	DOUBLE PRECISION	16-point Gauss-Legendre abscissa
WT16(8)	DOUBLE PRECISION	16-point Gauss-Legendre weights
XMU24(12)	DOUBLE PRECISION	24-point Gauss-Legendre abscissa
WT24(12)	DOUBLE PRECISION	24-point Gauss-Legendre weights
XMU32(16)	DOUBLE PRECISION	32-point Gauss-Legendre abscissa
WT32(16)	DOUBLE PRECISION	32-point Gauss-Legendre weights
XMU40(20)	DOUBLE PRECISION	40-point Gauss-Legendre abscissa
WT40(20)	DOUBLE PRECISION	40-point Gauss-Legendre weights
XMU80(40)	DOUBLE PRECISION	80-point Gauss-Legendre abscissa
WT80(40)	DOUBLE PRECISION	80-point Gauss-Legendre weights

XMU128(64)	DOUBLE PRECISION	128-point Gauss-Legendre abscissa
WT128(64)	DOUBLE PRECISION	128-point Gauss-Legendre weights
XMU512(256)	DOUBLE PRECISION	512-point Gauss-Legendre abscissa
WT512(256)	DOUBLE PRECISION	512-point Gauss-Legendre weights
NPTS(17)	INTEGER	Number of points in quadrature
MPTS(17)	INTEGER	Number of points in arrays

H2OPAR

This COMMON block contains the LOWTRAN band parameters of water vapor.

Common Block H2OPAR used in:
CH2OBD LOWTRN

Variable Name	Type	Description
CPH2O(3515)	REAL	LOWTRAN band model parameters for water vapor

HEADER

This COMMON block contains the variables which form the main header of the output binary files.

Common Block HEADER used in:

ATMPRN	BCKGND	BCKPRN	BNDPAR	BRBNDR	CALCUL
COUPLE	DEFALT	DEFBCK	ENDPT	EQABS	EQUABS
GETASP	GETATM	GETBCK	GETCLD	INICPL	INIGEO
INITL	KDISTR	MOSART	PRCALC	PRTHDR	PTHOSB
PUTCLD	PUTHDR	PUTSLR	RSHINE	SCNRIO	SETBCK
SRCFLX	SRCIRR	SUMFIL	TANGPT	USRDEF	ZROHDR
BBTEMP	GETHDR	PUTCLD	PUTSLR	SUMFIL	GETHDR
TABLEA	TABLEB	TABLEH	VISUAL	PLTDRV	PLTGEN
RDMSRT	ATMOUT	MRFLTR			

Variable Name	Type	Description
NGEOM	INTEGER	Number of geometries
NVSET	INTEGER	Number of spectral sets
NV(NVSMAX)	INTEGER	Number of spectral points/set
IFILE	INTEGER	Binary file index
NLAT	INTEGER	Number of latitudes
NLON	INTEGER	Number of longitudes
MA(MAXLAT, MAXLON)	INTEGER	Model atmosphere index
MP(MAXLAT, MAXLON)	INTEGER	Model pressure index
MT(MAXLAT, MAXLON)	INTEGER	Model temperature index
MC(ISMX,MAXLAT, MAXLON)	INTEGER	Model molecular concentrations index
IAERO1(MAXLAT, MAXLON)	INTEGER	Boundary layer aerosol index
IAERO2	INTEGER	Stratospheric aerosol index
IHAZE	INTEGER	Haze profile index
IUPPER	INTEGER	Upper atmosphere haze index
ICSTL(MAXLAT, MAXLON)	INTEGER	Air mass character index

IVSA	INTEGER	Vertical structure algorithm index
ISEASN	INTEGER	Season index
IEPHEM	INTEGER	Ephemeris index
ISOLAR	INTEGER	Solar switch
ISMPLS	INTEGER	Simple/complex solar calculation switch
ILUNAR	INTEGER	Lunar switch
ISMPLL	INTEGER	Simple/complex lunar calculation switch
IDAY	INTEGER	Day of the month
IMONTH	INTEGER	Month of the year
IYEAR	INTEGER	Year
ITIME	INTEGER	Time index
ICLDRN	INTEGER	Cloud/fog/rain/snow index
ICLOUD	INTEGER	Cloud index
ICIRUS	INTEGER	Cirrus index
IICE	INTEGER	Ice index
IRAIN	INTEGER	Rain index
ISNOW	INTEGER	Snow index
IBKGD	INTEGER	Background index
NAZ(NGMAX)	INTEGER	Number of observer-source azimuths
MAZ	INTEGER	Temporary storage for NAZ(NGMAX)
NASPCT (NGMAX)	INTEGER	Number of earth/skyshine elevation angles
IAZSH	INTEGER	Earth/skyshine index
NAZSH	INTEGER	Number of earth/skyshine azimuth angles
ITERM(NGMAX)	INTEGER	Observer-source path background index
JTERM(NGMAX, NAZMAX)	INTEGER	Observer-source path background index for each azimuth
KTERM(NASMAX, NZSMAX,NGMAX)	INTEGER	Earth/skyshine path background index
IDV(NVSMAX)	INTEGER	Spectral calculation index
ICOREF	INTEGER	Coordinate reference switch

IHTBLC	INTEGER	Background temperature switch
ISPCAL	INTEGER	Spectral calculation index
IMLSCT	INTEGER	Multiple scattering switch
IFBSW	INTEGER	Fore/background switch
IAZREF	INTEGER	Azimuth reference switch
ISLANG	INTEGER	Elevation/zenith angle switch
IANGSW(NGMAX)	INTEGER	Angle switch
IGMSW(NGMAX)	INTEGER	Geometry switch
ITPGM(NGMAX)	INTEGER	Geometry type index
IPAND(10)	INTEGER	Expansion positions for growth
VIS(MAXLAT, MAXLON)	REAL	Sea level meteorological range (km)
HOBS(NGMAX)	REAL	Observer altitude (km)
PHIOBS(NGMAX)	REAL	Observer elevation angle (deg)
HSRC(NGMAX)	REAL	Source altitude (km)
PHISRC(NGMAX)	REAL	Source elevation angle (deg)
HBCK	REAL	Background altitude (km)
PHIBCK(NGMAX)	REAL	Background elevation angle (deg)
SLROS(NGMAX)	REAL	Observer-source slant range (km)
BETAOS(NGMAX)	REAL	Observer-source earth center angle (deg)
SLROB(NGMAX)	REAL	Observer-background slant range (km)
BETAOB(NGMAX)	REAL	Observer-background earth center angle (deg)
HTANG(NGMAX)	REAL	Tangent altitude (km)
SOLEV	REAL	Solar elevation (deg)
SOLAZ	REAL	Solar azimuth (deg)
SOLDIS	REAL	Normalized solar distance
XLUNEV	REAL	Lunar elevation (deg)
XLUNAZ	REAL	Lunar azimuth (deg)
PHLUNR	REAL	Lunar phase (deg)
XLNDIS	REAL	Normalized lunar distance
AZIM(NAZMAX)	REAL	Observer/source azimuth (deg)
AZIML(NGMAX)	REAL	Azimuth if other latitude and longitude are defined (deg)
HOUR	REAL	Solar time (LST) (hour)

PHISH(NASMAX, NGMAX)	REAL	Earth/skyshine elevation angles (deg)
TAIR(MAXLAT, MAXLON)	REAL	Surface air temperature (K)
V1(NVSMAX)	REAL	Initial wavenumber (cm^{-1})
V2(NVSMAX)	REAL	Final wavenumber (cm^{-1})
DVI(NVSMAX)	REAL	Calculation increment (cm^{-1})
DWL(NVSMAX)	REAL	Calculation increment (μm)
PSRC(NGMAX, NAZMAX)	REAL	Source pressure (mb)
TSRC(NGMAX, NAZMAX)	REAL	Source temperature (K)
CSRC(7,NGMAX, NAZMAX)	REAL	Source molecular concentrations (ppmv)
HCIRBS	REAL	Cirrus base altitude (km)
DELCIR	REAL	Cirrus thickness (km)
ZINVSA	REAL	Inversion altitude (km)
WHH	REAL	24-hour mean wind speed (m/sec)
WIND(MAXLAT, MAXLON)	REAL	Local wind speed (m/sec)
WINDHI	REAL	Average stratospheric wind speed (m/sec)
XLAT(2,NGMAX)	REAL	Latitude of observer and source (deg)
XLONG(2,NGMAX)	REAL	Longitude of observer and source (deg)
TIME	REAL	Time of the day
TINF(MAXLAT, MAXLON)	REAL	Exospheric temperature
AZSH(NZSMAX)	REAL	Earth/skyshine azimuths (deg)
CLDCVR(0:3, MAXLAT,MAXLON)	REAL	Total/low/mid/high cloud cover (%)
HPRF(2)	REAL	Initial and final altitudes for profile (km)

APERT	REAL	Observer aperture diameter (m)
FOR	REAL	Observer field of regard (mrad)
CIREXT	REAL	Cirrus extinction coefficient at 0.55 μm (km^{-1})
CIRICE	REAL	Cirrus ice content (gm/m^3)
ULWSRC(NAZMAX, NGMAX)	REAL	Upward long-wave flux at source (W/m^2)
DLWSRC(NAZMAX, NGMAX)	REAL	Downward long-wave flux at source (W/m^2)
USWSRC(NAZMAX, NGMAX)	REAL	Upward short-wave flux at source (W/m^2)
DSWSRC(NAZMAX, NGMAX)	REAL	Downward short-wave flux at source (W/m^2)
BSWSRC(NAZMAX, NGMAX)	REAL	Beam short-wave flux at source (W/m^2)
CLALTB(3,MAXLAT, MAXLON)	REAL	Low/mid/high etage cloud base altitude (km)
CLALTT(3,MAXLAT, MAXLON)	REAL	Low/mid/high etage cloud top altitude (km)
CN2SRF	REAL	Structure constant at surface ($m^{-2/3}$)
XLATSL	REAL	Solar latitude (deg)
XLONSL	REAL	Solar longitude (deg)
XLATLN	REAL	Lunar latitude (deg)
XLONLN	REAL	Lunar longitude (deg)
XPAND(10)	REAL	Expansion positions for growth

HERZBG

This COMMON block contains the parameters for the Herzberg absorption bands of molecular oxygen in the ultraviolet.

Common Block HERZBG used in:
ABSO2 O2UVBD

Variable Name	Type	Description
NWLOXY	INTEGER	Number of spectral points
WLOXY(248)	REAL	Wavelength (μm)
SDOXY(248)	REAL	Absorption coefficient (km^{-1})
AOXY(248)	REAL	Pressure correction term (1.E-26 cm^2 $torr^{-1}$)

HZDATA

This COMMON block contains the parameters for the model haze profiles.

Common Block HZDATA used in:
HAZE HAZEBD

Variable Name	Type	Description
VS(5)	REAL	Sea level meteorological ranges (km)
ZBNDR(NZBNDR)	REAL	Boundary layer altitudes (km)
HZBNDR(NZBNDR,5)	REAL	Boundary layer haze extinction coefficients (km^{-1})
ZTROP(NZTROP)	REAL	Troposphere altitudes (km)
HZTROP(NZTROP, 2,2)	REAL	Troposphere haze extinction coefficients (km^{-1}) with seasonal variability for meteorological ranges for 23 and 50 km
ZSTRA(NZSTRA)	REAL	Stratosphere altitudes (km)
HZSTRA(NZSTRA, 2,4)	REAL	Stratosphere haze extinction coefficients (km^{-1}) with season variability as a function of volcanic activity (i.e., background, moderate, high, and extreme)
ZUPPR(NZUPR)	REAL	Upper atmosphere altitudes (km)
HZUPPR(NZUPR,2,2)	REAL	Upper atmosphere haze extinction coefficients (km^{-1}) with variations due to volcanic activity (i.e., background and volcanic) and upper atmosphere haze level (i.e., normal and extreme)

ICEREF

This COMMON block contains the index of refraction of ice.

Common Block ICEREF used in:
ICEBD INDEXI

Variable Name	Type	Description
NWLICE	INTEGER	Number of spectral points for WLICE
WLICE(468)	REAL	Wavelength (μm)
XMRE(468)	REAL	Real component of the index of refraction
XMIM(468)	REAL	Imaginary component of the index of refraction
NWLJ	INTEGER	Number of spectral points for WLJ
WLJ(62)	REAL	Wavelength (μm)
YMRE(62,4)	REAL	Temperature-dependent real component of the index of refraction
YMIM(62,4)	REAL	Temperature-dependent imaginary component of the index of refraction
TEMICE(4)	REAL	Temperature (K)

INBKGD

This COMMON block contains the sample user-defined background input file.

Common Block INBKGD used in:
CRBKGD INBKBD

Variable Name	Type	Description
INPBCK(39)	CHARACTER*60	User-defined background records
INPSCN(80)	CHARACTER*80	User-defined scene records

INDXWR

This COMMON block contains the index of refraction of water.

Common Block INDXWR used in:
INDEXW WTRBD

Variable Name	Type	Description
WLWTR(NWLWTR)	REAL	Wavelength (μm)
WTRINR(NWLWTR)	REAL	Real component of the index of refraction
WTRINI(NWLWTR)	REAL	Imaginary component of the index of refraction
FRGHZ(NFRQ)	REAL	Frequency (GHz)
WTDER(NFRQ)	REAL	Real component of the microwave index of refraction
WTDEI(NFRQ)	REAL	Imaginary component of the microwave index of refraction

INFLTR

This COMMON block contains the sample user-defined filter response input file.

Common Block INFLTR used in:
CRFLTR INFLBD RDFLTR

Variable Name	Type	Description
INPFLT(57)	CHARACTER*56	Filter response records

INITAL

This COMMON block contains the final atmospheric parameter arrays.

Common Block INITAL used in:

BBARSL	BMOD	BNDPAR	BRBNDR	CALCUL	COUPLE
ENDPT	EPHEMS	EQUABS	GEOM	HYDROM	INICPL
INIGEO	INITL	LOWTRN	MOSART	PLMSUB	PRCALC
PRETEM	PTHOSB	PUTHDR	RAYPTH	RSHINE	SCNRIO
SETALT	SHNGEO	SRCGEO	SRCIRR	TANGPT	MRFLTR

Variable Name	Type	Description
RE	DOUBLE PRECISION	Radius of the earth (km)
ML	INTEGER	Number of altitudes in final atmospheric profile
ZL(MLMAX)	REAL	Altitude (km)
PL(MLMAX,MAXLAT, MAXLON)	REAL	Pressure (mb)
TL(MLMAX,MAXLAT, MAXLON)	REAL	Temperature (K)
W(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	Equivalent absorber amounts for each molecular type (amagat)
IAERO(MLMAX, MAXLAT,MAXLON)	INTEGER	Aerosol model index
LOBSV(NGMAX)	INTEGER	Position of observer in altitude profile
LSRCE(NGMAX)	INTEGER	Position of source in altitude profile
LBKGD	INTEGER	Position of background in altitude profile
DTDP(MLMAX, MAXLAT,MAXLON)	REAL	d(Theta)/d(Phi) calculated from refractive index profile
XMH(MLMAX, MAXLAT,MAXLON)	REAL	Refractive bending constant

CN2(MLMAX, MAXLAT,MAXLON)	REAL	Turbulence structure constant ($m^{-2/3}$)
RHL(MLMAX, MAXLAT,MAXLON)	REAL	Relative humidity
PRTNFN(ISMX, MLMAX,MAXLAT, MAXLON)	REAL	Molecular partition functions
CLDLWC(MLMAX, MAXLAT,MAXLON)	REAL	Cloud liquid water content (gm/m^3)
CLDICE(MLMAX, MAXLAT,MAXLON)	REAL	Cloud ice content (gm/m^3)
RRATE(MLMAX, MAXLAT,MAXLON)	REAL	Rain rate (mm/hr)
SRATE(MLMAX, MAXLAT,MAXLON)	REAL	Snow rate (mm/hr)
NTRPAU(MAXLAT, MAXLON)	INTEGER	Position of tropopause in altitude profile
NSTPAU(MAXLAT, MAXLON)	INTEGER	Position of stratopause in altitude profile
ML0	INTEGER	Initial number of altitudes in atmosphere profile, before any tangent points are added
LMIN(MLMAX)	INTEGER	Pointer to altitude of tangent points
LSOLAR	INTEGER	Position of sun in altitude profile
LLUNAR	INTEGER	Position of moon in altitude profile
CT2(MLMAX, MAXLAT,MAXLON)	REAL	Temperature structure constant ($m^{-2/3}$ K^2)

CSM2(MLMAX, MAXLAT,MAXLON)	REAL	Molecular scattering structure constant ($m^{-2/3}$ km^{-2})
CSA2(MLMAX, MAXLAT,MAXLON)	REAL	Aerosol scattering structure constant ($m^{-2/3}$ km^{-2})
SKYFAC(3,MLMAX, MAXLAT,MAXLON)	REAL	Sky noise factor

INPNDX

This COMMON block contains the indices for the sub-sections for the MOSART input file.

Common Block INPNDX used in:

CRINPT CRUATM INPTBD RDMDTN

Variable Name	Type	Description
INPDX(18)	INTEGER	Indices for MOSART input file sub-sections

INPTDT

This COMMON block contains the sample input file.

Common Block INPTDT used in:

INITL INPTBD CRINPT CRUATM INPTBD RDMDTN

Variable Name	Type	Description
INPSTR(202)	CHARACTER*50	Input file records
TITL	CHARACTER*80	Input file title
GEOMST(3)	CHARACTER*80	Sample geometry records
ANTEST(8)	CHARACTER*80	Antecedent parameter records
SUBTIT(17)	CHARACTER*50	Subsection headings
ATMPAR(19)	CHARACTER*80	User-defined atmosphere records

INTSTO

This COMMON block contains intermediate spectral data the integrated in-band values.

Common Block INTSTO used in:
ATMPRN INTEG PRCALC RSHINE ZROINT ATMINT

Variable Name	Type	Description
RADSH(NASMAX, NZSMAX)	REAL	Spectral earth/skyshine thermal radiance ($W/cm^2/sr/cm^{-1}$)
TAUSH(NASMAX, NZSMAX)	REAL	Spectral skyshine transmittance
RADSE(NASMAX, NZSMAX)	REAL	Spectral earth/skyshine terminator emitted radiance ($W/cm^2/sr/cm^{-1}$)
RADSS(NASMAX, NZSMAX)	REAL	Spectral earth/skyshine terminator reflected radiance ($W/cm^2/sr/cm^{-1}$)
RADSHT(NASMAX, NZSMAX,NGMAX)	REAL	Integrated Earth/Skyshine Thermal Radiance ($W/cm^2/sr$)
TAUSHT(NASMAX, NZSMAX,NGMAX)	REAL	Integrated earth/skyshine transmittance
RADSET(NASMAX, NZSMAX,NGMAX)	REAL	Integrated earth/skyshine terminator emitted radiance ($W/cm^2/sr$)
RADSST(NASMAX, NZSMAX,NGMAX)	REAL	Integrated earth/skyshine terminator reflected radiance ($W/cm^2/sr$)
RADSC(NASMAX, NZSMAX)	REAL	Spectral earth/skyshine scattered radiance ($W/cm^2/sr/cm^{-1}$)
RADSCT(NASMAX, NZSMAX,NGMAX)	REAL	Integrated earth/skyshine scattered radiance ($W/cm^2/sr$)
RSLSTT(NAZMAX, NGMAX)	REAL	Integrated scattered observer-source line-of-sight radiance ($W/cm^2/sr$)

RSLSBT(NAZMAX, NGMAX)	REAL	Integrated scattered observer-background line-of-sight radiance ($W/cm^2/sr$)
RADBE(NAZMAX)	REAL	Spectral emitted observer line-of-sight terminator radiance ($W/cm^2/sr/cm^{-1}$)
RADBET(NAZMAX, NGMAX)	REAL	Integrated emitted observer line-of-sight terminator radiance ($W/cm^2/sr$)
RADBR(NAZMAX)	REAL	Spectral reflected observer line-of-sight terminator radiance ($W/cm^2/sr/cm^{-1}$)
RADBRT(NAZMAX, NGMAX)	REAL	Integrated reflected observer line-of-sight terminator radiance ($W/cm^2/sr$)
RADSD(NAZMAX)	REAL	Spectral terminator radiance standard deviation ($W/cm^2/sr/cm^{-1}$)
RADSDT(NAZMAX, NGMAX)	REAL	Integrated terminator radiance standard deviation ($W/cm^2/sr$)
TAU1(NAZMAX, NGMAX)	REAL	Spectral observer-source transmittance
TAU2(NAZMAX, NGMAX)	REAL	Spectral observer-background transmittance
SGMETT(NAZMAX, NGMAX)	REAL	Integrated source scintillation
SGMEBT(NAZMAX, NGMAX)	REAL	Integrated background scintillation
TASCTT(NAZMAX, NGMAX)	REAL	Integrated forward in-scatter transmittance to source
TASCBT(NAZMAX, NGMAX)	REAL	Integrated forward in-scatter transmittance to background
RAD1(NAZMAX, NGMAX)	REAL	Integrated thermal path radiance observer-source line-of-sight ($W/cm^2/sr$)

RAD2(NAZMAX, NGMAX)	REAL	Integrated thermal path radiance observer-background line-of-sight ($W/cm^2/sr$)
RDSLT(NAZMAX, NGMAX)	REAL	Integrated source solar irradiance (W/cm^2)
RDLNT(NAZMAX, NGMAX)	REAL	Integrated source lunar irradiance (W/cm^2)
DRADTT(NAZMAX, NGMAX)	REAL	Integrated path standard deviation observer-source line-of-sight ($W/cm^2/sr$)
DRADBT(NAZMAX, NGMAX)	REAL	Integrated path standard deviation observer-background line-of-sight ($W/cm^2/sr$)
BCKSUM(2,NMATL, NAZMAX,NGMAX)	REAL	Integrated terrain material radiances in sun and shade ($W/cm^2/sr$)

INUAER

This COMMON block contains the sample user-defined aerosol input file.

Common Block INUAER used in:
CRUAER INARBD

Variable Name	Type	Description
INPAER(32)	CHARACTER*60	Aerosol file records

INUCLD

This COMMON block contains the sample user-defined hydrometeor input file.

Common Block INUCLD used in:
CRUCLD INCLBD

Variable Name	Type	Description
INPCLD(30)	CHARACTER*80	User-defined hydrometeor file records

KDISDT

This COMMON block contains the parameters for the exponential sum fit used in the multiple scattering calculations.

Common Block KDISDT used in:
KDISTR PRCALC

Variable Name	Type	Description
EXTNCA(MLMAX, MAXLAT,MAXLON)	REAL	Extinction coefficient (km^{-1})
ALBA(MLMAX, MAXLAT,MAXLON)	REAL	Aerosol albedo
ALBM(MLMAX, MAXLAT,MAXLON)	REAL	Molecular albedo

LAGUER

This COMMON block contains Gauss-Laguerre coefficients.

Common Block LAGUER used in:
ESFIT LAGRBD

Variable Name	Type	Description
XLGA(2)	DOUBLE PRECISION	2-point Gauss-Laguerre abscissa
WLGA(2)	DOUBLE PRECISION	2-point Gauss-Laguerre weights
WLGEXA(2)	DOUBLE PRECISION	2-point Gauss-Laguerre weights time EXP(-XLG2)
XLGB(3)	DOUBLE PRECISION	3-point Gauss-Laguerre abscissa
WLGB(3)	DOUBLE PRECISION	3-point Gauss-Laguerre weights
WLGEXB(3)	DOUBLE PRECISION	3-point Gauss-Laguerre weights time EXP(-XLG3)
XLGC(4)	DOUBLE PRECISION	4-point Gauss-Laguerre abscissa
WLGC(4)	DOUBLE PRECISION	4-point Gauss-Laguerre weights
WLGEXC(4)	DOUBLE PRECISION	4-point Gauss-Laguerre weights time EXP(-XLG4)
XLGD(5)	DOUBLE PRECISION	5-point Gauss-Laguerre abscissa
WLGD(5)	DOUBLE PRECISION	5-point Gauss-Laguerre weights
WLGEXD(5)	DOUBLE PRECISION	5-point Gauss-Laguerre weights time EXP(-XLG5)
XLGE(6)	DOUBLE PRECISION	6-point Gauss-Laguerre abscissa
WLGE(6)	DOUBLE PRECISION	6-point Gauss-Laguerre weights
WLGEXE(6)	DOUBLE PRECISION	6-point Gauss-Laguerre weights time EXP(-XLG6)
XLGF(7)	DOUBLE PRECISION	7-point Gauss-Laguerre abscissa
WLGF(7)	DOUBLE PRECISION	7-point Gauss-Laguerre weights
WLGEXF(7)	DOUBLE PRECISION	7-point Gauss-Laguerre weights time EXP(-XLG7)
XLGG(8)	DOUBLE PRECISION	8-point Gauss-Laguerre abscissa
WLGG(8)	DOUBLE PRECISION	8-point Gauss-Laguerre weights
WLGEXG(8)	DOUBLE PRECISION	8-point Gauss-Laguerre weights time EXP(-XLG8)
XLGH(9)	DOUBLE PRECISION	9-point Gauss-Laguerre abscissa
WLGH(9)	DOUBLE PRECISION	9-point Gauss-Laguerre weights
WLGEXH(9)	DOUBLE PRECISION	9-point Gauss-Laguerre weights time EXP(-XLG9)

XLGI(10)	DOUBLE PRECISION	10-point Gauss-Laguerre abscissa
WLGI(10)	DOUBLE PRECISION	10-point Gauss-Laguerre weights
WLGEXI(10)	DOUBLE PRECISION	10-point Gauss-Laguerre weights time EXP(-XLG10)
XLGJ(12)	DOUBLE PRECISION	12-point Gauss-Laguerre abscissa
WLGJ(12)	DOUBLE PRECISION	12-point Gauss-Laguerre weights
WLGEXJ(12)	DOUBLE PRECISION	12-point Gauss-Laguerre weights time EXP(-XLG12)
XLGK(15)	DOUBLE PRECISION	15-point Gauss-Laguerre abscissa
WLGK(15)	DOUBLE PRECISION	15-point Gauss-Laguerre weights
WLGEXK(15)	DOUBLE PRECISION	15-point Gauss-Laguerre weights time EXP(-XLG15)

LYRSTO

This COMMON block contains the irradiance parameters for each layer in the atmospheric profile.

Common Block LYRSTO used in:

COUPLE INICPL MLSCAT PRCALC PTHOSB RSHINE SCNRIO

Variable Name	Type	Description
PLNK(MLMAX, MAXLAT,MAXLON)	REAL	Blackbody spectral radiance for layer temperature ($W/cm^2/sr/cm^{-1}$)
SOLYR(MLMAX, MAXLAT,MAXLON)	REAL	Solar spectral irradiance ($W/cm^2/cm^{-1}$)
XLNLYR(MLMAX, MAXLAT,MAXLON)	REAL	Lunar spectral irradiance ($W/cm^2/cm^{-1}$)
USOLAR(MLMAX, NBAND,MAXLAT, MAXLON)	REAL	Upward diffuse reflection term for sun per exponential fit band
DSOLAR(MLMAX, NBAND,MAXLAT, MAXLON)	REAL	Downward diffuse reflection term for sun per exponential fit band
ULUNAR(MLMAX, NBAND,MAXLAT, MAXLON)	REAL	Upward diffuse reflection term for moon per exponential fit band
DLUNAR(MLMAX, NBAND,MAXLAT, MAXLON)	REAL	Downward diffuse reflection term for moon per exponential fit band
RLAYER(0:MLMAX+1, NBAND,MAXLAT, MAXLON)	REAL	Layer reflectance
TLAYER(0:MLMAX+1, NBAND,MAXLAT, MAXLON)	REAL	Layer transmittance

HMI(0:MLMAX+1, NBAND)	REAL	Multiple scattered downward flux (thermal/solar) for each exponential fit band ($W/cm^2/sr/cm^{-1}$)
HPI(0:MLMAX+1, NBAND)	REAL	Multiple scattered upward flux (thermal/solar) for each exponential fit band ($W/cm^2/sr/cm^{-1}$)
SOLEVL(MLMAX)	REAL	Solar elevation angle (deg)
XLNEVL(MLMAX)	REAL	Lunar elevation angle (deg)
HP(2,MLMAX, MAXLAT,MAXLON NSPCMX)	REAL	Total multiple scattered upward flux (thermal/solar) ($W/cm^2/sr/cm^{-1}$)
HM(2,MLMAX, MAXLAT,MAXLON, NSPCMX)	REAL	Total multiple scattered downward flux (thermal/solar) ($W/cm^2/sr/cm^{-1}$)
DPLKDT(MLMAX, MAXLAT,MAXLON NSPCMX)	REAL	Derivative of Planck blackbody function with temperature ($W/cm^2/sr/cm^{-1}/K$)

MACHIN

This COMMON block contains the machine indices for machine dependent operations.

Common Block MACHIN used in:

CRBKGD CRFLTR CRINPT CRUAER CRUATM CRUCLD
DEVCBD FPTEST FLSTAT

Variable Name	Type	Description
ICMPTR(2)	INTEGER	Machine-dependent indices
LRMAX	INTEGER	Maximum allowed record length

MATERL

This COMMON block contains the parameters for the materials used in the user-defined aerosol model.

Common Block MATERL used in:
DNDR MIEINP MIEPHS

Variable Name	Type	Description
XN(3,100,5)	COMPLEX	Spectral indices of refraction for two core materials and core material
NSD(5)	INTEGER	Number of points in user-defined size distribution
SIG(5)	REAL	Standard deviation for log normal size distribution
R0(5)	REAL	Mean radius for log normal or breakpoint radius for Junge size distribution (μm)
SNU(5)	REAL	Junge size distribution parameter
REFF(5)	REAL	Effective radius for Hansen size distribution (μm)
VEFF(5)	REAL	Effective variance for Hansen size distribution
ALPHA(5)	REAL	Modified Gamma size distribution parameter
GAMMA(5)	REAL	Modified Gamma size distribution parameter
B(5)	REAL	Modified Gamma size distribution parameter
SDIST(50,5)	REAL	User-defined size distribution
PCT(5)	REAL	Fraction of particle radius that is core
RDCOTI(5)	REAL	Initial particle radius (μm)
RDCOTF(5)	REAL	Final particle radius (μm)
WLAU(100,5)	REAL	Wavelength (μm)
NWLAU(5)	INTEGER	Number of spectral points
NINTR(5)	INTEGER	Number of integration points

ITYPEP(5)	INTEGER	Particle size distribution index
ITYPEI(5)	INTEGER	Core inclusion index
ITYPEM(3,5)	INTEGER	Material indices for core (2) and coating
FR1(5)	REAL	Fraction of core that is first material

MIECOT

This COMMON block contains the scattering matrix components used in the Mie calculations.

Common Block MIECOT used in:
COAT MIE MIEPHS

Variable Name	Type	Description
S1(NXMIE)	COMPLEX	Unknown parameter
S2(NXMIE)	COMPLEX	Unknown parameter
S11(NXMIE)	REAL	(1,1)- and (2,2)-element of the Mueller matrix times PI times scattering efficiency divided the wavelength squared
S12(NXMIE)	REAL	(1,2)- and (2,1)-element of the Mueller matrix times PI times scattering efficiency divided the wavelength squared
S33(NXMIE)	REAL	(3,3)- and (4,4)-element of the Mueller matrix times PI times scattering efficiency divided the wavelength squared
S34(NXMIE)	REAL	(3,4)- and minus the (4,3)-element of the Mueller matrix times PI times scattering efficiency divided by the wavelength squared
AMU(NXMIE)	REAL	Cosine of scattering angle
PII(NXMIE,2)	REAL	Unknown parameter

MMWREF

This COMMON block contains the parameters for calculating millimeter wave refractivity.

Common Block MMWREF used in:
REFRAC REFRBD

Variable Name	Type	Description
FRQO2(42)	REAL	Oxygen line frequencies (GHz)
SO2(42)	REAL	Oxygen line strengths at 300 K
ALFO2(42)	REAL	Oxygen line widths at 300 K (GHz/torr)
PINTER(42)	REAL	Interference parameter at 300 K
TINTER(42)	REAL	Interference temperature correction
LQPO2(42)	INTEGER	Oxygen line quantum parameter
VH20(56)	REAL	Water vapor line frequencies (GHz)
SH20(56)	REAL	Water vapor line strengths
ALFH20(56)	REAL	Water vapor line widths (cm^{-1}/torr)
ELSH20(56)	REAL	Ground energy state (K)

MOLCON

This COMMON block contains the parameters for the molecular concentrations.

Common Block MOLCON used in:

BMOD	BNDPAR	BRBNDR	ENDPT	EQABS	EQUABS
LOWTRN	MOLPBD	PLMSUB	PRCALC	PRETEM	PUTHDR
SCNRIO	TANGPT				

Variable Name	Type	Description
CMOL(28,MLIDMX, MLMAX,MAXLAT, MAXLON	REAL	Molecular concentrations (ppmv)
NNN	INTEGER	Number of molecules used in plume binary output file

MOLDAT

This COMMON block contains the parameters for the molecular partition functions.

Common Block MOLDAT used in:
BMOD EQABS MOLPBD PARTIT XMCONV

Variable Name	Type	Description
NW(MLIDMX)	INTEGER	Number of energy levels for vibration partition function
WMOL(MLIDMX,10)	REAL	Energy levels for vibration partition function
NDEG(MLIDMX,10)	INTEGER	Degeneracy of each energy level for vibration partition function
XK(MLIDMX)	REAL	Exponent for rotational partition function
AIRMWT	REAL	Molecular weight of air
AMWT(MLIDMX)	REAL	Molecular weights

MOLECP

This COMMON block contains indexing information for each molecule in the direct access binary data files.

Common Block MOLECP used in:

ABSMOL	BAND	BBARSL	BMOD	BNDPAR	DBINIT
DFLT8	DVINCR	EMISSV	ENDPT	EQABS	EQUABS
KDISTR	PLMSUB	PRCALC	PTHOSB	PTHTAU	PUTHDR
SCNRIO	SUMFIL	TANGPT	USRDEF	BBTEMP	VISUAL

Variable Name	Type	Description
NMOLEC	INTEGER	Number of molecules
MOLID(MLIDMX)	INTEGER	Molecular index (see Section 7.0)
NVA(MLIDMX)	INTEGER	Number of spectral groups in binary data files
VA(30,MLIDMX)	REAL	Initial wavenumber (cm^{-1}) for spectral group
VB(30,MLIDMX)	REAL	Final wavenumber (cm^{-1}) for spectral group
IVA(30,MLIDMX)	INTEGER	Direct access record number for the beginning of each spectral group
DVM(MLIDMX)	REAL	Spectral resolution (cm^{-1})
DVREF	REAL	Reference spectral increment in molecular data bases (cm^{-1})
IPLUM(6)	INTEGER	Plume molecular index

MSPARM

This COMMON block contains the exponential sum fit parameters for the multiple scattering calculations.

Common Block MSPARM used in:
COUPLE INICPL PRCALC

Variable Name	Type	Description
AMS(NBAND, MLMAX,MAXLAT, MAXLON)	REAL	Weights
XKMS(NBAND, MLMAX,MAXLAT, MAXLON)	REAL	Exponential terms

NAVMAR

This COMMON block contains the parameters for the Navy Aerosol Model.

Common Block NAVMAR used in:
MARINE MARNBD

Variable Name	Type	Description
TQEXT(3,40,4)	REAL	Extinction coefficient (km^{-1}) as a function of wind speed, wavelength, and relative humidity
TQABS(3,40,4)	REAL	Absorption coefficient (km^{-1}) as a function of wind speed, wavelength, and relative humidity
WL(40)	REAL	Wavelength (μm)
RELHUM(4)	REAL	Relative humidity

NO2XS

This COMMON block contains the cross-sections of nitrogen dioxide between 14,095 and 49,970 cm^{-1}.

Common Block NO2XS used in:
ABSNO2 NO2BD

Variable Name	Type	Description
VBEG	REAL	Initial wavenumber (cm^{-1})
VEND	REAL	Final wavenumber (cm^{-1})
VINCR	REAL	Wavenumber increment (cm^{-1})
CRSNO2(NMAX)	REAL	Cross-section of nitrogen dioxide

O3CWB

This COMMON block contains the cross-section of the Chappuis and Wulf band of ozone between 9,170 and 24,565 cm^{-1}.

Common Block O3CWB used in:
ABSO3 O3CWBD

Variable Name	Type	Description
VBEG	REAL	Initial wavenumber (cm^{-1})
VEND	REAL	Final wavenumber (cm^{-1})
VINCR	REAL	Wavenumber increment (cm^{-1})
CT0(NMAX)	REAL	Zeroth order parameter for cross-section ($amagat^{-1}$ cm^{-1})
CT1(NMAX)	REAL	First order parameter for cross-section ($amagat^{-1}$ cm^{-1} K^{-1})
CT2(NMAX)	REAL	Second order parameter for cross-section ($amagat^{-1}$ cm^{-1} K^{-2})

O3PAR

This COMMON block contains the LOWTRAN band parameters of ozone.

Common Block O3PAR used in:
CPO3BD LOWTRN

Variable Name	Type	Description
CPO3(447)	REAL	LOWTRAN band model parameters for ozone

OMATLW

This COMMON block contains the altitude arrays used in the broad band heat transfer calculations.

Common Block OMATLW used in:
FLUXLW OPATH SOLBND TRANLW

Variable Name	Type	Description
ULW(10,10)	REAL	Optical path matrix for water vapor
VLW(10,10)	REAL	Optical path matrix for carbon dioxide
WLW(10,10)	REAL	Optical path matrix for ozone
XLW(10,10,2)	REAL	Optical path matrix for aerosol scattering
YLW(10,10)	REAL	Optical path matrix for Rayleigh scattering
ZLW(10,10,2)	REAL	Optical path matrix for aerosol absorption
TU(10,10)	REAL	Temperature-weighted optical path matrix for water vapor
TV(10,10)	REAL	Temperature-weighted optical path matrix for carbon dioxide
TW(10,10)	REAL	Temperature-weighted optical path matrix for ozone
TX(10,10)	REAL	Temperature-weighted optical path matrix for aerosols
TM(10,10)	REAL	Effective temperature (K) matrix
TF(10,10)	REAL	Transmission matrix

OPTDEP

This COMMON block contains the optical depths for the various atmospheric constituents.

Common Block OPTDEP used in:
PRCALC PTHTAU RSHINE

Variable Name	Type	Description
XSS(ISMX,MLMX2)	DOUBLE PRECISION	Optical depth for each atmospheric constituent at each point along the ray

OUTPUT

This COMMON block contains the switch that controls the ASCII output.

Common Block OUTPUT used in:
ATMPRN BCKPRN BRBNDR EQUABS INITL

Variable Name	Type	Description
IPRNDX	INTEGER	ASCII output length index

O2C

This COMMON block contains the parameters for the molecular oxygen continuum.

Common Block O2C used in:
O2CBD O2CNT

Variable Name	Type	Description
NPTO2	INTEGER	Number of spectral points
VO2(2)	REAL	Initial and final wavenumbers (cm^{-1})
DVO2	REAL	Incremental wavenumber (cm^{-1})
O2S0(74)	REAL	Absorption coefficient ($amagat^{-1}\ cm^{-1}$)
O2A(74)	REAL	Temperature dependent coefficient (K^{-1})
O2B(74)	REAL	Temperature dependent coefficient (K^{-2})

O3HHB

This COMMON block contains the parameters for the Hartley-Huggins band of ozone in the visible and ultraviolet.

Common Block O3HHB used in:
ABSO3 O3HHBD

Variable Name	Type	Description
V1C	REAL	Initial wavenumber (cm^{-1}) for 27370 - 29400 cm^{-1} region
V2C	REAL	Final wavenumber (cm^{-1}) for 27370 - 29400 cm^{-1} region
DVC	REAL	Wavenumber increment (cm^{-1})
NC	INTEGER	Number of spectral points
CO3DT(3,2687)	REAL	Absorption coefficient (amagat^{-1} cm^{-1})
V1O	REAL	Initial wavenumber (cm^{-1}) for 40800 - 54054 cm^{-1} region
V2O	REAL	Final wavenumber (cm^{-1}) for 40800 - 54054 cm^{-1} region
DVO	REAL	Wavenumber increment (cm^{-1})
NO	INTEGER	Number of spectral points
CO3DAT(133)	REAL	Absorption coefficient (amagat^{-1} cm^{-1})

PATH1

This COMMON block contains various parameters for the observer-source-background path. See Figure 3.

Common Block PATH1 used in:
CALCUL PLMSUB PRCALC PTHOSB SCNRIO SRCGEO

Variable Name	Type	Description
NSRCE	INTEGER	Number of points between observer and source
NBKGD	INTEGER	Number of points between observer and background
DOSB(MLMX2)	REAL	Differential slant ranges (km) between observer and source-background
IOSB(MLMX2)	INTEGER	Pointers to altitude profile along the observer-source-background path
VARXZ(MLMX2, NAZMAX)	REAL	Scintillation parameter along the observer-source-background path
RSCINT(MLMX2)	REAL	Running sum of DOSB (km)
SOLEVB(NAZMAX)	REAL	Solar elevation angle at background (rad)
XLNEVB(NAZMAX)	REAL	Lunar elevation angle at background (rad)
PHIOSB(MLMX2)	REAL	Elevation angle (rad) along the observer-source-background path
ACCAPT(2)	REAL	Sensor aperture acceptance angle (rad) for forward in-scatter along the observer-source-background path
THOSB(MLMX2)	REAL	Earth center angle (rad) along the observer-source-background path

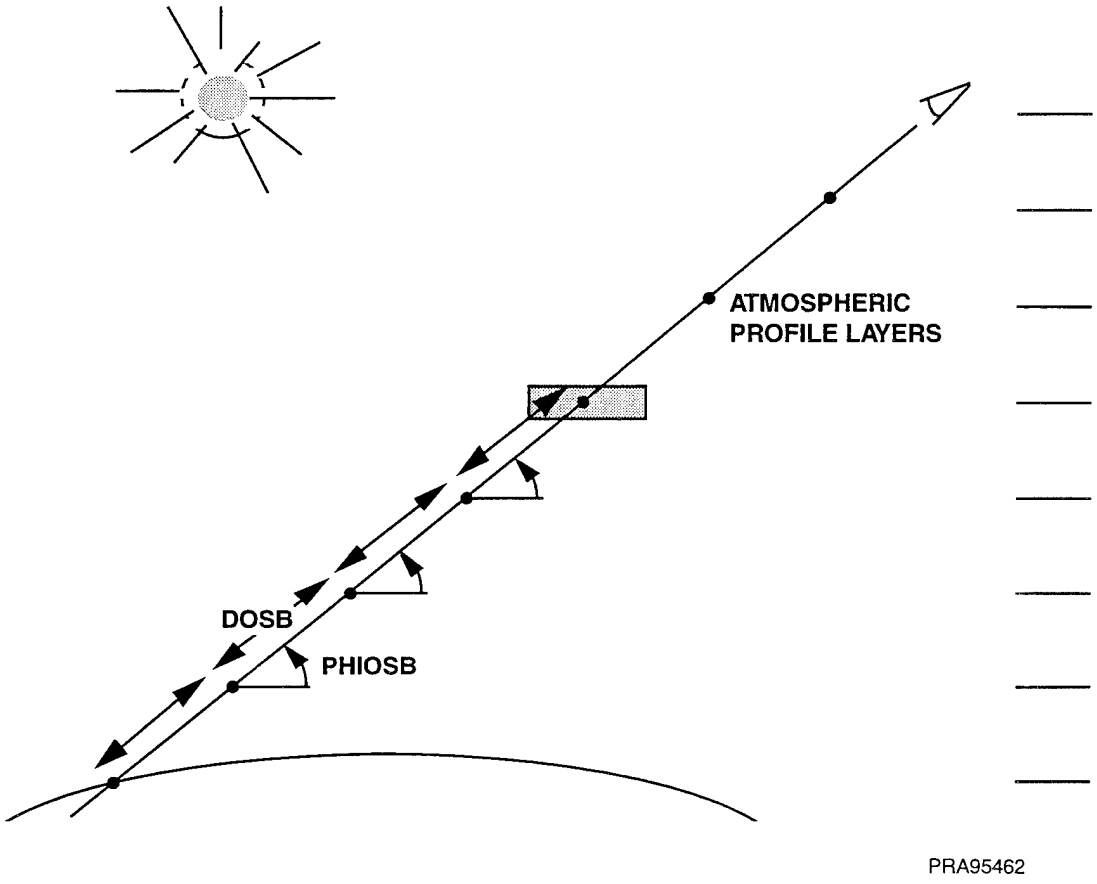


Figure 3. Observer-Source-Background Path. COMMON Block: PATH1.

PATH1A

Common Block PATH1A used in:
CALCUL PLMSUB PRCALC SCNRIO

Variable Name	Type	Description
PTHLAT(MLMX2, NAZMAX	REAL	Latitude along path (deg)
PTHLON(MLMX2, NAZMAX	REAL	Longitude along path (deg)
PTHFAC(MAXLAT, MAXLON,MLMX2, NAZMAX)	REAL	Interpolation factor along path
NPTHFC(2,2, NAZMAX)	INTEGER	Limits of grid where geometry is valid
FRSNW(NAZMAX)	REAL	Fraction snow in terrain
FRWTR(NAZMAX)	REAL	Fraction water in terrain
FRICE(NAZMAX)	REAL	Fraction ice in terrain

PATH2

This COMMON block contains the parameters for the earth/skyshine rays at the source paths. See Figure 4.

Common Block PATH2 used in:
RSHINE SRCIRR

Variable Name	Type	Description
NSH	INTEGER	Number of points along each earth/skyshine path
DRSH(MLMX2)	REAL	Differential slant ranges (km) along each earth/skyshine path
ISH(MLMX2)	INTEGER	Pointer to altitude profile along each earth/skyshine path
PHISHL(MLMX2)	REAL	Elevation angles (rad) along each earth/skyshine path
SHNFAC(MAXLAT, MAXLON,MLMX2, NZSMAX)	REAL	Interpolation factor for global atmosphere for each point along earth/skyshine path
SHSNW(NZSMAX)	REAL	Fraction snow cover on terrain at path end
SHICE(NZSMAX)	REAL	Fraction ice on terrain at path end
SHWTR(NZSMAX)	REAL	Fraction water on terrain at path end
NSHNFC(2,2, NSHNFC)	INTEGER	Limits of grid where geometry is valid

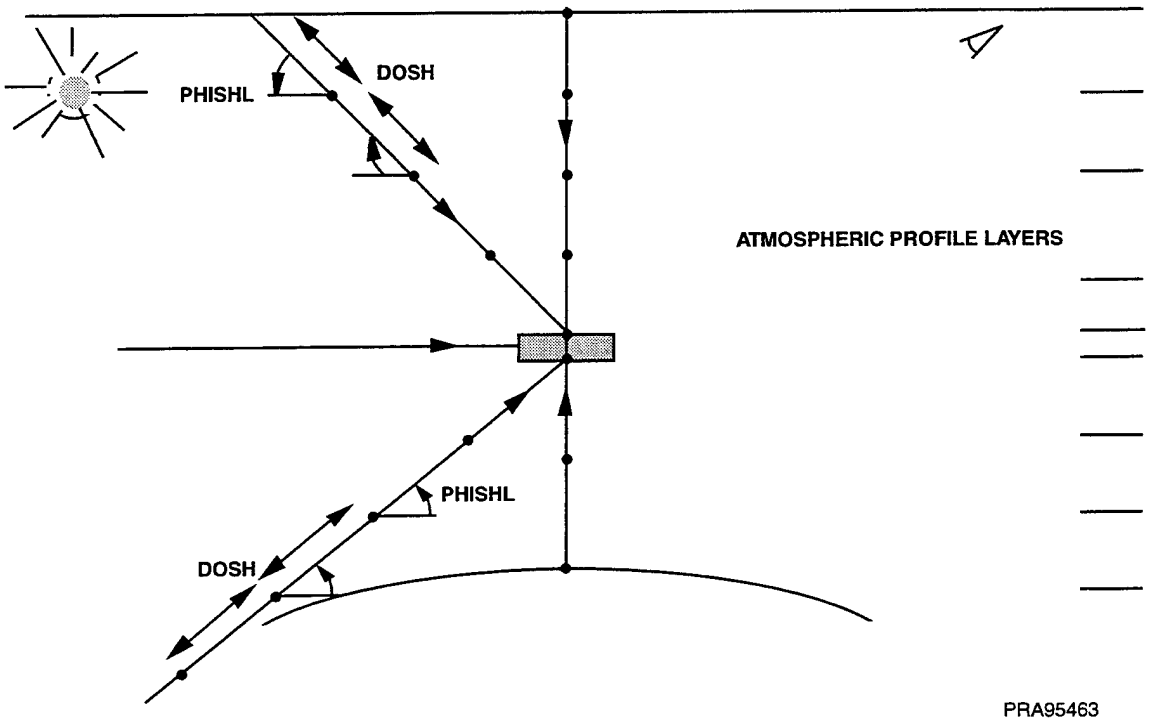


Figure 4. Sky/Earthshine Ray Path at Source. There is a set of paths for each user-specified observer-source azimuth angle. COMMON Block: PATH3.

PATH2A

This COMMON block contains the parameters for each intermediate point along a source earth/skyshine ray to the sun. See Figure 5. For example, for each skyshine ray, if there are 3 different azimuth angles, and there are 10 intermediate points along each of the skyshine rays, there will be a total of 30 path dealt with in this COMMON block.

Common Block PATH2A used in:
RSHINE SRCIRR

Variable Name	Type	Description
NSHSL(NZSMAX, MLMX2,NASMAX)	INTEGER	Number of points along each ray between each point along the points along an earth/skyshine path and the sun
ISHSL(ISTMAX)	INTEGER	Pointers to the altitude profile along each earth/skyshine-solar path; since there are 4*32 = 128 possible earth/skyshine paths, and up to 200 points for each path, there 25,600 points; each point has a ray to the sun with up to 200 points each, so there can be up to 5.12 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.

DRSHSL(ISTMAX)	REAL	Differential slant ranges (km) along each earth/skyshine-solar path; since there are 4*32 = 128 possible earth/skyshine paths, and up to 200 points for each path, there 25,600 points; each point has a ray to the sun with up to 200 points each, so there can be up to 5.12 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.
SSLFAC(MAXLAT, MAXLON,ISTMAX)	REAL	Interpolation factor for latitude variations in global atmosphere for each point along earth/skyshine-solar path
NSSLFC(2,2)	INTEGER	Limits of grid where geometry is valid

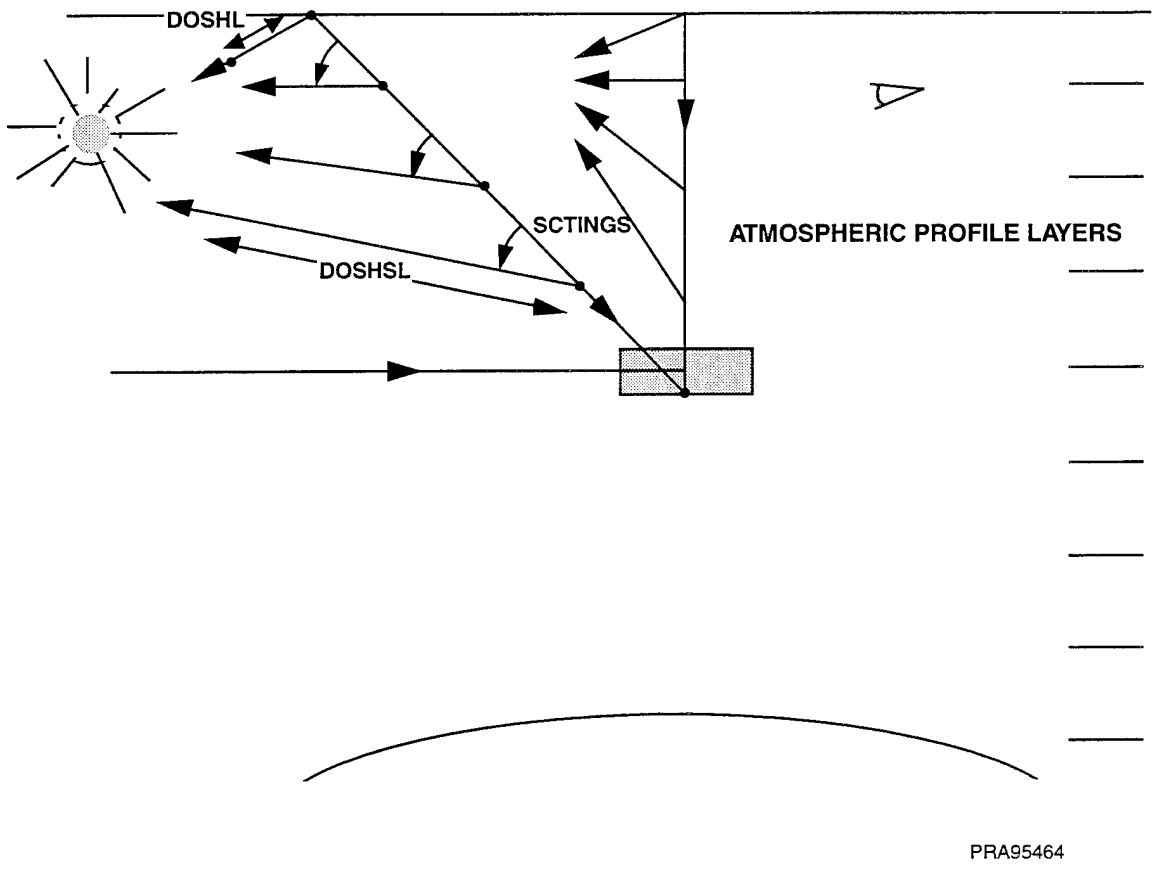


Figure 5. Sky/Earthshine Rays at Source Intermediate Point-to-Sun Paths. There is a set of paths as shown above for each user-specified receiver-target azimuth angle. COMMON Blocks: PATH 2A, 2B, 2C, 2H, 2I, 2J, 2L, 2M, 2N.

PATH2B

This COMMON block contains the parameters for each intermediate point along a source earth/skyshine ray to the sun. See Figure 5. For example, for each skyshine ray, if there are 3 different azimuth angles, and there are 10 intermediate points along each of the skyshine rays, there will be a total of 270 path dealt with in this COMMON block.

Common Block PATH2B used in:
RSHINE SRCIRR

Variable Name	Type	Description
NDXSH(NZSMAX, MLMX2)	INTEGER	Pointers to the starting position of each path
SCTNGS(NZSMAX, MLMX2)	REAL	Solar scattering angle (deg) along earth/skyshine paths
SLEVSH(NZSMAX)	REAL	Solar elevation angle (deg) at earth/skyshine path termination

PATH2C

This COMMON block contains the parameters for each intermediate point along a source earth/skyshine ray to the sun. See Figure 5. For example, for each skyshine ray, if there are 3 different azimuth angles, and there are 10 intermediate points along each of the skyshine rays, there will be a total of 270 path dealt with in this COMMON block.

Common Block PATH2C used in:
RSHINE SRCIRR

Variable Name	Type	Description
NSHLN(NZSMAX, MLMX2)	INTEGER	Number of points along each ray between each point along the points along a earth/skyshine path and the moon
ISHLN(ISTMAX)	INTEGER	Pointers to the altitude profile along each earth/skyshine-lunar path; since there are 4*32 = 128 possible earth/skyshine paths, and up to 200 points for each path, there 25,600 points; each point has a ray to the moon with up to 200 points each, so there can be up to 5.12 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.

DRSHLN(ISTMAX)	REAL	Differential slant ranges (km) along each earth/skyshine-lunar path; since there are 4*32 = 128 possible earth/skyshine paths, and up to 200 points for each path, there 25,600 points; each point has a ray to the moon with up to 200 points each, so there can be up to 5.12 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.
SLNFAC(MAXATM, ISTMA)	REAL	Interpolation factor for latitude variations in global atmosphere for each point along earth/skyshine-lunar path
NSLNFC(2,2)	INTEGER	Limits of grid where geometry is valid

PATH2D

This COMMON block contains the parameters for each intermediate point along a source earth/skyshine ray to the moon. See Figure 5. For example, for each skyshine ray, if there are 3 different azimuth angles, and there are 10 intermediate points along each of the skyshine rays, there will be a total of 270 path dealt with in this COMMON block.

Common Block PATH2D used in:
RSHINE SRCIRR

Variable Name	Type	Description
NDXSHL(NZSMAX, MLMX2)	INTEGER	Pointers to the starting position of each path
SCTNGL(NZSMAX, MLMX2)	REAL	Lunar scattering angle (deg) along earth/skyshine paths
XLEVSH(NZSMAX)	REAL	Lunar elevation angle (deg) at earth/skyshine path termination

PATH4

This COMMON block contains the celestial coordinates for the termination of each path.

Common Block PATH4 used in:
CALCUL COUPLE PRCALC RSHINE SCNRIO SRCIRR

Variable Name	Type	Description
XLGALT(NAZMAX)	REAL	Galactic azimuth (deg) of observer line-of-sight
BGALT(NAZMAX)	REAL	Galactic elevation (deg) of observer line-of-sight
XLECLT(NAZMAX)	REAL	Ecliptic azimuth (deg) of observer line-of-sight
BECLT(NAZMAX)	REAL	Ecliptic elevation (deg) of observer line-of-sight
XLGALS(NASMAX, NZSMAX)	REAL	Galactic azimuth (deg) of earth/skyshine line-of-sight
BGALS(NASMAX, NZSMAX)	REAL	Galactic elevation (deg) of earth/skyshine line-of-sight
XLECLS(NASMAX, NZSMAX)	REAL	Ecliptic azimuth (deg) of earth/skyshine line-of-sight
BECLS(NASMAX, NZSMAX)	REAL	Ecliptic elevation (deg) of earth/skyshine line-of-sight
XLGALC(MAXLAT, MAXLON)	REAL	Galactic azimuth for each atmosphere (deg)
BGALC(MAXLAT, MAXLON)	REAL	Galactic elevation for each atmosphere (deg)
XLECLC(MAXLAT, MAXLON)	REAL	Ecliptic azimuth for each atmosphere (deg)
BECLC(MAXLAT, MAXLON)	REAL	Ecliptic elevation for each atmosphere (deg)

FRSNWL(MAXLAT, MAXLON)	REAL	Fraction snow cover at each latitude and longitude
FRWTRL(MAXLAT, MAXLON)	REAL	Fraction water at each latitude and longitude
FRICEL(MAXLAT, MAXLON)	REAL	Fraction ice at each latitude and longitude

PATH5A

This COMMON block contains the parameters for the paths from each intermediate point along the observer-source-background path to the sun. There is one set of paths for each user-specified observer-source azimuth angle. For example, if there are 100 intermediate points along the observer-source-background path and there are 3 observer-source azimuth angles, the arrays in this COMMON block will deal with a total of 300 paths. See Figure 6.

Common Block PATH5A used in:
CALCUL DEFBCK PRCALC SCNRIO

Variable Name	Type	Description
NTBSL(NAZMAX, MLMX2)	INTEGER	Number of points along each observer-source-background/ solar path
NDXSL(NAZMAX, MLMX2)	INTEGER	Pointers to the starting position of each path
SCTANG(NAZMAX, MLMX2)	REAL	Scattering angle (deg) to the sun at the initial point for each path

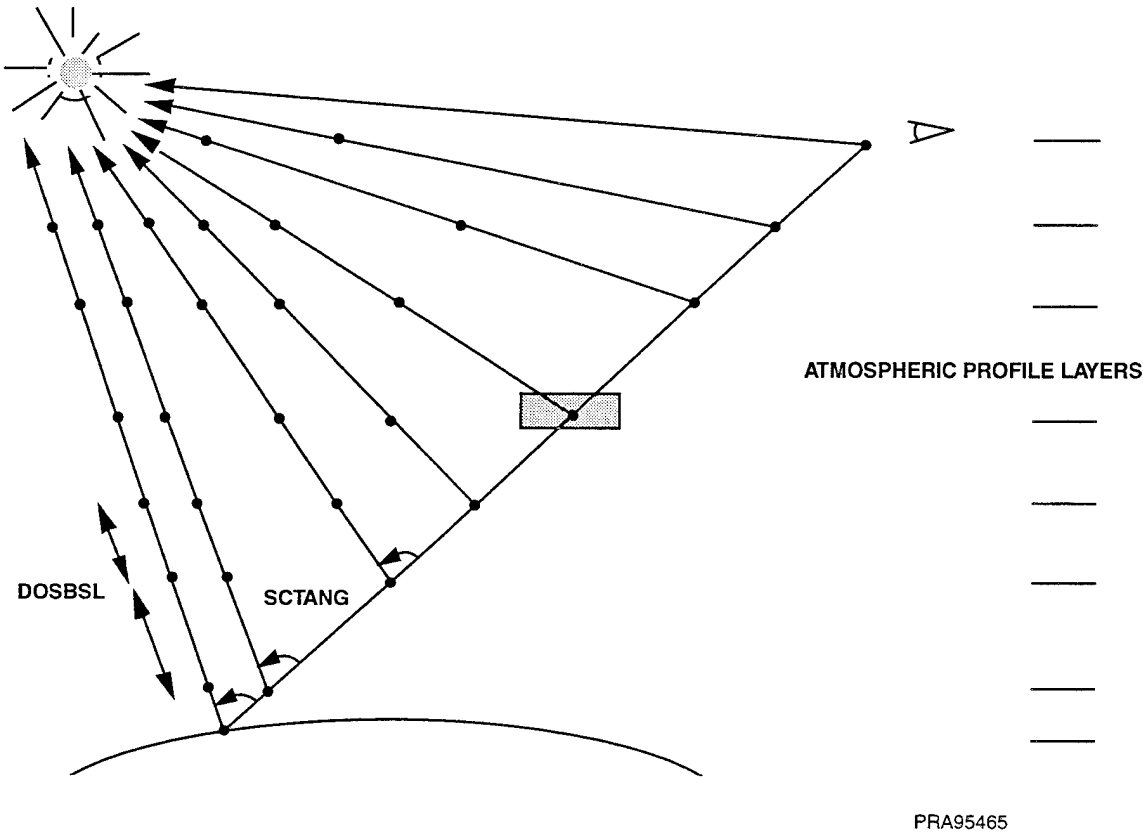


Figure 6. Observer-Source-Background Intermediate Point-to-Sun Paths. There is a set of paths as shown for each user-specified observer-source azimuth angle. COMMON Blocks: PATH 5A, 5B, 5C, 5D, 5E, 5F.

PATH5B

This COMMON block contains the parameters for the paths from each intermediate point along the observer-source-background path to the sun. There is one set of paths for each user-specified observer-source azimuth angle. For example, if there are 100 intermediate points along the observer-source-background path and there are 3 observer-source azimuth angles, the arrays in this COMMON block will deal with a total of 300 paths. See Figure 6.

Common Block PATH5B used in:
CALCUL PRCALC SCNRIO

Variable Name	Type	Description
ITBSL(ISTMAX)	INTEGER	Pointers to the altitude profile along each observer-source-background/solar path; since there are NAZMAX possible azimuths, and up to MLMX2 points for each path, each point has a ray to the sun with up to MLMX2 points each, so there can be up to 0.32 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.

DOSBSL(ISTMAX)	REAL	Differential slant ranges (km) along each observer-source-background/solar path; since there are NAZMAX possible azimuths, and up to MLMX2 points for each path, and each point has a ray to the sun with up to MLMX2 points each, so there can be up to 0.32 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.
SLXFAC(MAXLAT, MAXLON,ISTMAX)	REAL	Interpolation factor for global atmosphere for each point along observer-source-background/solar path
NSLXFC(2,2)	INTEGER	Limits of grid where geometry is valid

PATH5C

This COMMON block contains the parameters for the paths from each intermediate point along the observer-source-background path to the moon. There is one set of paths for each user-specified observer-source azimuth angle. For example, if there are 100 intermediate points along the observer-source-background path and there are 3 observer-source azimuth angles, the arrays in this COMMON block will deal with a total of 300 paths. See Figure 6.

Common Block PATH5C used in:
CALCUL DEFBCK PRCALC SCNRIO

Variable Name	Type	Description
NTBLN(NAZMAX, MLMX2)	INTEGER	Number of points along each observer-source-background/ moon path
NDXLN(NAZMAX, MLMX2)	INTEGER	Pointers to the starting position of each path
SCTNGX(NAZMAX, MLMX2)	REAL	Scattering angle (deg) to the moon at the initial point for each path

PATH5D

This COMMON block contains the parameters for the paths from each intermediate point along the observer-source-background path to the moon. There is one set of paths for each user-specified observer-source azimuth angle. For example, if there are 100 intermediate points along the observer-source-background path and there are 3 observer-source azimuth angles, the arrays in this COMMON block will deal with a total of 300 paths. See Figure 6.

Common Block PATH5D used in:
CALCUL PRCALC SCNRIO

Variable Name	Type	Description
ITBLN(ISTMAX)	INTEGER	Pointers to the altitude profile along each observer-source-background/lunar path; since there are NAZMAX possible azimuths, and up to MLMX2 points for each path, each point has a ray to the moon with up to MLMX2 points each, so there can be up to 0.32 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.

DOSBLN(ISTMAX)	REAL	Differential slant ranges (km) along each observer-source-background/lunar path; since there are NAZMAX possible azimuths, and up to MLMX2 points for each path, each point has a ray to the moon with up to MLMX2 points each, so there can be up to 0.32 million points possible; tests have shown that ISTMAX will handle most reasonable geometries; if the total number of points exceeds ISTMAX, these values are written to a scratch file and a warning message is given.
XLXFAX(MAXLAT, MAXLON,ISTMAX)	REAL	Interpolation factor for global atmosphere for each point along observer-source-background/lunar path
NXLXFC(2,2)	INTEGER	Limits of grid where geometry is valid

PATH6

This COMMON block contains the parameters for the sun-source-earth path. See Figure 7.

Common Block PATH6 used in:
CALCUL PRCALC SCNRIO

Variable Name	Type	Description
NBSLR(MLMAX)	INTEGER	Number of points along sun-source-earth path
ITBSLR(MLMX2, MLMAX)	INTEGER	Pointer to altitude profile along sun-source-earth path
DRBSLR(MLMX2, MLMAX)	REAL	Differential slant ranges (km) along sun-source-earth path
SOLFAC(MAXLAT, MAXLON,MLMX2, MLMAX)	REAL	Interpolation factor for global atmosphere for each point along sun-observer-earth path
NSOLFC(2,2, MLMAX)	INTEGER	Limits of grid where geometry is valid

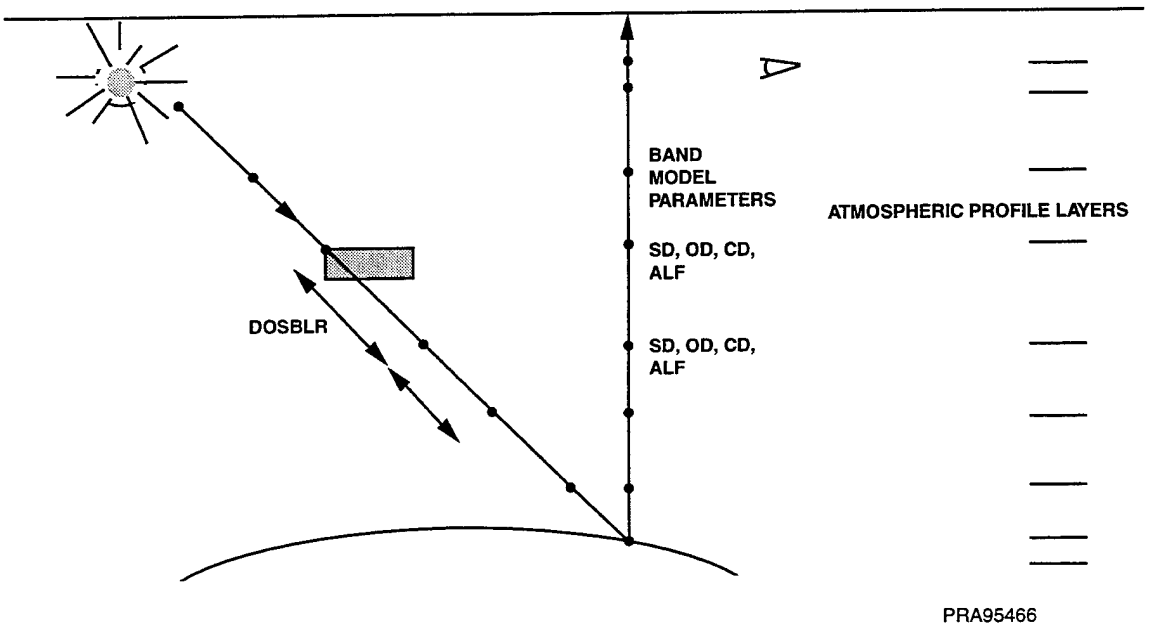


Figure 7. Sun-Source-Earth Path and Spectral Band Model Parameters for Vertical Earth-to-Space Path. COMMON Blocks: PATH6 PATH8.

PATH8

This COMMON block contains the parameters for the moon-source-earth path. See Figure 7.

Common Block PATH8 used in:
CALCUL PRCALC SCNRIO

Variable Name	Type	Description
NBLNR(MLMAX)	INTEGER	Number of points along moon-source-earth path
ITBLNR(MLMX2, MLMAX)	INTEGER	Pointer to altitude profile along moon-source-earth path
DRBLNR(MLMX2, MLMAX)	REAL	Differential slant ranges (km) along moon-source-earth path
XLNFAC(MAXLAT, MAXLON,MLMX2, MLMAX)	REAL	Interpolation factor for global atmosphere for each point along moon-source-earth path
NLUNFC(2,2, MLMAX)	INTEGER	Limits of grid where geometry is valid

PERLUN

This COMMON block contains the Brown perturbation terms for the lunar longitude, latitude, and parallax.

Common Block PERLUN used in:
EPHEML LUNPBD

Variable Name	Type	Description
NLON	INTEGER	Number of longitude perturbation terms
PLON(50,5)	REAL	Longitude perturbations
NLAT	INTEGER	Number of latitude perturbation terms
PLAT(20,5)	REAL	Latitude perturbations
NPAR	INTEGER	Number of parallax perturbation terms
PPAR(20,5)	REAL	Parallax perturbations

PHFFOG

This COMMON block contains the phase functions for the advection and radiation LOWTRAN fog models.

Common Block PHFFOG used in:
PHFGBD PHFUNC

Variable Name	Type	Description
NWLFG	INTEGER	Number of wavelengths
WLFG(NWLAER)	REAL	Wavelength (μm)
PHFOGS(2,NWLAER, NANG)	REAL	Phase function (sr^{-1})
PHFGSY(2,NWLAER)	REAL	Asymmetry factor

PHFMAR

This COMMON block contains marine aerosol parameters.

Common Block PHFMAR used in:
PHFUNC PHMABD

Variable Name	Type	Description
NWLMA	INTEGER	Number of wavelength points
WLMA(27)	REAL	Wavelength (μm)
PHMARI(4,27,NANG)	REAL	Phase function
PHMASY(4,47)	REAL	Asymmetry parameter

PHFOCE

This COMMON block contains the single scattering phase functions for the Navy Oceanic Aerosol Model.

Common Block PHFOCE used in:
PHFUNC PHOCBD

Variable Name	Type	Description
NWLOC	INTEGER	Number of spectral points
WLOC(27)	REAL	Wavelength (μm)
PHOCEA(4,27,NANG)	REAL	Phase functions
PHOCSY(4,27)	REAL	Asymmetry parameter

PHFRUR

This COMMON block contains the single scattering phase functions for the relative humidity dependent Urban Aerosol Model.

Common Block PHFRUR used in:
PHFUNC PHRUBD

Variable Name	Type	Description
NWLRU	INTEGER	Number of spectral points
WLRU(27)	REAL	Wavelength (μm)
PHRURL(4,27,NANG)	REAL	Phase functions
PHRUSY(4,27)	REAL	Asymmetry parameter

PHFSTR

This COMMON block contains the phase functions for the stratospheric and mesospheric aerosol models.

Common Block PHFSTR used in:
PHFUNC PHSTBD

Variable Name	Type	Description
NWLST	INTEGER	Number of wavelengths
WLST(27)	REAL	Wavelength (μm)
PHSTRA(4,27,NANG)	REAL	Phase function (sr^{-1})
PHSTSY(4,27)	REAL	Asymmetry factor

PHFTRP

This COMMON block contains the phase functions for the relative humidity dependent tropospheric aerosol model.

Common Block PHFTRP used in:
PHFUNC PHTRBD

Variable Name	Type	Description
NWLTR	INTEGER	Number of wavelengths
WLTR(27)	REAL	Wavelength (μm)
PHTROP(4,27,NANG)	REAL	Phase function (sr^{-1})
PHTRSY(4,27)	REAL	Asymmetry factor

PHFURB

This COMMON block contains the single scattering phase functions for the relative humidity dependent Urban Aerosol Model.

Common Block PHFURB used in:
PHFUNC PHURBD

Variable Name	Type	Description
NWLUR	INTEGER	Number of spectral points
WLUR(27)	REAL	Wavelength (μm)
PHURBN(4,27,NANG)	REAL	Phase functions
PHURSY(4,27)	REAL	Asymmetry parameter

PHHYDR

This COMMON block contains the phase functions for the cloud/fog models.

Common Block PHHYDR used in:
PHHYBD PHYDRO

Variable Name	Type	Description
WLC(NWLCLD)	REAL	Wavelength (μm)
PHCLSY(15,4, NWLCLD)	REAL	Cloud asymmetry factor
RRTMP(7)	REAL	Marshall-Palmer rain rates (mm/hr)
PHRNSY(8,4, NWLCLD)	REAL	Rain asymmetry factor
TMPRN(4)	REAL	Rain temperatures (K)
TMPSN(4)	REAL	Snow temperatures (K)

PLMDAT

This COMMON block contains the band model parameters for the plume binary data file for use in the multiple line groups.

Common Block PLMDAT used in:

ENDPT EQUABS PLMSUB TANGPT

Variable Name	Type	Description
PLUMEF(NNNMAX, NGAS,MLMAX, MAXLAT,MAXLON)	REAL	Line strength partition function
PLUMEG(NGAS, MLMAX,MAXLAT, MAXLON)	REAL	Fine structure partition function

PLTPRM

This COMMON block contains various plotting parameters.

Common Block PLTPRM used in:
PLTBD PLTDRV RDMSRT

Variable Name	Type	Description
XAXL	REAL	Length of x-axis (inches) (7.0)
YAXL	REAL	Length of y-axis (inches) (4.0)
NMOLEC	INTEGER	Number of molecules
MOLID(NSMX)	INTEGER	Molecular index
NCURVE	INTEGER	Number of curve elements

PRBNDA

This COMMON block contains the spectral band model parameters for each molecule for each layer in the atmospheric profile array (vertical path). These band parameters are recalculated for each spectral bin.

Common Block PRBNDA used in:

BMOD BNDPAR INICPL KDISTR LOWTRN PLMSUB PTHOSB PTHTAU

Variable Name	Type	Description
SD(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	S/d for each molecule for a given spectral bin at each intermediate point in the atmospheric profile (amagat^{-1} cm^{-1})
OD(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	1/d for each molecule for a given spectral bin at each intermediate point in the atmospheric profile (amagat^{-1} cm^{-1})
SC(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	Scattering coefficient (km^{-1})
QA(ISMX)	REAL	Exponent for LOWTRAN double exponent band model
IBAND(ISMX)	INTEGER	Index for type of band model to be used for each molecule 0 - exponential 1 - Voight band model 2 - Double exponent band model
ISPECS(NSPCMX)	INTEGER	Number of molecular species plus molecular scatter, aerosols, and hydrometeors
IMDATA(ISMX)	INTEGER	Switch set if molecular line strength greater than zero

PRBNDB

This COMMON block contains the spectral band model parameters for each molecule for each layer in the atmospheric profile array (vertical path). These band parameters are recalculated for each spectral bin.

Common Block PRBNDB used in:

BMOD BNDPAR INICPL KDISTR LOWTRN PLMSUB PTHTAU

Variable Name	Type	Description
AL(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	Molecular line width (cm^{-1}) at STP
AD(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	Doppler line width (cm^{-1}) at STP
CD(ISMX,MLMAX, MAXLAT,MAXLON)	REAL	Continuum absorption coefficient (km^{-1})

RAINTP

This COMMON block contains the parameters for the rain models. The size parameter has the following form:

$$dN/dD = n0 * EXP(-A * D * (rate^{**}B))$$

with drop diameter, D, in μm and the rate in mm/hr.

Common Block RAINTP used in:
RAINBD RAINEX RAINSP

Variable Name	Type	Description
XN0(5)	REAL	n0
ARAIN(5)	REAL	A
BRAIN(5)	REAL	B

RAINWL

This COMMON block contains the spectral parameters for the rain models.

Common Block RAINWL used in:
RAINBD RAINSP SNOWSP

Variable Name	Type	Description
WLRN(NWLCLD)	REAL	Wavelength (μm)
RNTMP(7)	REAL	Rain rate (mm/hr)
CAR(7,4,NWLCLD)	REAL	Rain normalized absorption coefficient
CXR(7,4,NWLCLD)	REAL	Rain normalized extinction coefficient
CSX(4,NWLCLD)	REAL	Snow normalized absorption coefficient
CSA(4,NWLCLD)	REAL	Snow normalized extinction coefficient
TEMPRN(4)	REAL	Rain parameter temperatures (K)
TEMPSN(4)	REAL	Snow parameter temperatures (K)

RMODAT

This COMMON block contains various parameters used in the plotting routines.

Common Block RMODAT used in:
PLTDRV RDMSRT

Variable Name	Type	Description
WAVLNG(NUMPTS, NUMCRV)	REAL	Wavelength (μm) or wavenumber (cm^{-1})
XMAX	REAL	Maximum spectral limit (μm or cm^{-1})
XMIN	REAL	Minimum spectral limit (μm or cm^{-1})
PATRAD(NUMPTS, NAZMAX,NUMCRV)	REAL	Path radiance ($W/cm^2/sr/\mu m$ or $W/cm^2/sr/cm^{-1}$)
ATMAX	REAL	Maximum value of both PATRAD and BKGRAD ($W/cm^2/sr/\mu m$ or $W/cm^2/sr/cm^{-1}$)
ATMIN	REAL	Minimum value of both PATRAD and BKGRAD ($W/cm^2/sr/\mu m$ or $W/cm^2/sr/cm^{-1}$)
PRYMAX(NAZMAX)	REAL	Maximum value of PATRAD ($W/cm^2/sr/\mu m$ or $W/cm^2/sr/cm^{-1}$)
BKGRAD(NUMPTS, NAZMAX,NUMCRV)	REAL	Background radiance ($W/cm^2/sr/\mu m$ or $W/cm^2/sr/cm^{-1}$)
BRYMAX(NAZMAX)	REAL	Maximum value of BKGRAD ($W/cm^2/sr/\mu m$)
TRAN(NUMPTS, NAZMAX,NUMCRV)	REAL	Transmission, forward in-scatter transmission, and scintillation with respect to the source
TRNMOL(NUMPTS,3, NAXMAX,NUMCRV, NSMX)	REAL	Molecular band, line wing, and total transmittance

RSTART

This COMMON block contains the switch and the local for a restarting of the calculations.

Common Block RSTART used in:
BINFIL CALCUL

Variable Name	Type	Description
NGEOMR	INTEGER	Geometry to restart
NVR	INTEGER	Spectral value to restart
NVS	INTEGER	Spectral bin to restart
LRSTRT	LOGICAL	Flag to restart or not

SCENES

This COMMON block contains the parameters to define the structured terrain scenes.

Common Block SCENES used in:
ATMPRN SCENBD SETBCK TERMPR USRBCK

Variable Name	Type	Description
NSCENE	INTEGER	Number of scenes
SCENE(NSCEN, NMATL)	REAL	Fraction of each scene that consists of each material
CORLEN(NSCNE, NMATL)	REAL	Correlation length for each material (m)
PSDSLP(NSCNE, NMATL)	REAL	PSD slope of each material
STDEVM(NSCNE, NMATL)	REAL	Log base 10 of the standard deviation relative to the mean for each material
RGCORL(NSCEN)	REAL	Roughness correlation length (m)
RGSTDV(NSCEN)	REAL	Log base 10 of the roughness standard deviation relative to the mean
RGPWRL(NSCEN)	REAL	Roughness PSD slope

SHURUN

This COMMON block contains the parameters for the Schumann-Runge band parameters for molecular oxygen in the ultraviolet.

Common Block SHURUN used in:
ABSO2 O2UVBD

Variable Name	Type	Description
VSHO2(2)	REAL	Wavenumber limits (cm^{-1})
DVSHO2	REAL	Increment (cm^{-1})
SHNO2(424)	REAL	Logarithm (base 10) of absorption coefficient

SILEMS

This COMMON block contains the volumetric emissivity of zodiacal light.

Common Block SILEMS used in:
EMISSV ZOD1BD

Variable Name	Type	Description
NPTWL	INTEGER	Number of wavelength values
NDIST	INTEGER	Number of distance values
VOLMIS(291,33)	REAL	Volumetric emissivity of zodiacal light ($W/cm^2/sr/cm^{-1}$)

SNWDAT

This COMMON block contains the parameters for the snow models.

Common Block SNWDAT used in:
SNOWBD SNOWEX

Variable Name	Type	Description
ASNW(6,3)	REAL	Polynomial coefficients for crystal velocity
BSNW(6,2)	REAL	Polynomial coefficients for crystal diameter
RHOWTR(56)	REAL	Water density (gm/cm^3) as a function of temperature
RHOICE	REAL	Ice density (gm/m^3)

SO2XS

This COMMON block contains the cross-sections of sulfur dioxide between 24,820 and 52,625 cm^{-1}.

Common Block SO2XS used in:
ABSSO2 SO2BD

Variable Name	Type	Description
VBEG	REAL	Initial wavenumber (cm^{-1})
VEND	REAL	Final wavenumber (cm^{-1})
VINCR	REAL	Wavenumber increment (cm^{-1})
CRSSO2(NMAX)	REAL	Cross-section for sulfur dioxide ($amagat^{-1}$ cm^{-1})

SOLIR1

This COMMON block contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 0 and 10,000 cm^{-1}.

Common Block SOLIR1 used in:
SLRCNT SOLAR SOLRBD

Variable Name	Type	Description
SOLAR1(10000)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)
SOLRCN	REAL	Solar constant (W/cm^2)

SOLIR2

This COMMON block contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 10,001 and 20,000 cm^{-1}.

Common Block SOLIR2 used in:
SLRCNT SOLAR SOLRBD

Variable Name	Type	Description
SOLAR2(10000)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)
SOLRCN	REAL	Solar constant (W/cm^2)

SOLIR3

This COMMON block contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 20,001 and 30,000 cm^{-1}.

Common Block SOLIR3 used in:
SLRCNT SOLAR SOLRBD

Variable Name	Type	Description
SOLAR3(10000)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)
SOLRCN	REAL	Solar constant (W/cm^2)

SOLIR4

This COMMON block contains the spectral irradiance of the sun at the earth for the mean earth-sun distance between 30,001 and 40,000 cm^{-1}.

Common Block SOLIR4 used in:
SLRCNT SOLAR SOLRBD

Variable Name	Type	Description
SOLAR4(10000)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)
SOLRCN	REAL	Solar constant (W/cm^2)

SOLIR5

This COMMON block contains the spectral irradiance of the sun at the earth for the mean earth-sun distance above 40,000 cm^{-1}.

Common Block SOLIR5 used in:
SLRCNT SOLAR SOLRBD

Variable Name	Type	Description
SOLAR5(10000)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)
SOLRCN	REAL	Solar constant (W/cm^2)
NPTSB	INTEGER	Number of spectral points for 50,001 - 57,420 cm^{-1}
DVB	REAL	Resolution (cm^{-1})
SOLARB(760)	REAL	Solar irradiance ($W/cm^2/cm^{-1}$)

STDMOL

This COMMON Block contain the molecular concentrations for the model atmospheres.

Common Block STDMOL used in:
EQABS STMLBD USRDEF

Variable Name	Type	Description
AMOL(NL,24,7)	REAL	Molecular concentration profiles for each of the major molecular species for each model atmosphere (ppmv)

SWPARM

This COMMON block contains various parameters used in the short wave broad band heat flux calculations taken from Lacis and Hansen.

Common Block SWPARM used in:
BRBNBD SOLBND

Variable Name	Type	Description
AK(3,8)	REAL	Unknown parameter
PSW(3,8)	REAL	Unknown parameter
BF(3)	REAL	Fraction of solar flux in each band
ALAM(3)	REAL	Wavelength (μm)
IKBAND(3)	INTEGER	Number of elements per band

TMPOCN

This COMMON block contains the ocean temperatures.

Common Block TMPOCN used in:
OCNTBD SEATMP

Variable Name	Type	Description
OCNTMP(4,36,72)	REAL	Ocean temperatures (K)
POTEMP(3,36)	REAL	Average mean potential temperatures (°C)

TRACEG

This COMMON block contains the LOWTRAN band parameter for the trace gases.

Common Block TRACEG used in:
LOWTRN TRACBD

Variable Name	Type	Description
CPNH3(431)	REAL	LOWTRAN band model parameters for ammonia
CPNO(62)	REAL	LOWTRAN band model parameters for nitric oxide
CPNO2(142)	REAL	LOWTRAN band model parameters for hydrogen dioxide
CPSO2(226)	REAL	LOWTRAN band model parameters for sulfur dioxide

TRANSP

This COMMON block contain the transmission for each molecular species, aerosol, and hydrometeor.

Common Block TRANSP used in:
PRCALC TRNSMT

Variable Name	Type	Description
SPCTRN(ISMX,3, NAZMAX)	REAL	Transmission for each of the atmospheric components

UFMIX

This COMMON block contains the LOWTRAN band parameters for the uniformly mixed gases.

Common Block UFMIX used in:
LOWTRN UMIXBD

Variable Name	Type	Description
CPCO(173)	REAL	LOWTRAN band model parameters for carbon monoxide
CPCH4(493)	REAL	LOWTRAN band model parameters for methane
CPN20(704)	REAL	LOWTRAN band model parameters for nitrous oxide
CPO2(382)	REAL	LOWTRAN band model parameters for oxygen

UFTAPE

This COMMON block contains the parameters required to read the MODTRAN band model tape, UFTAPE.

Common Block UFTAPE used in:
ABSMOL UFTPBD

Variable Name	Type	Description
NBLOCK	INTEGER	Number of blocks of data on UFTAPE
IFREQ(273)	INTEGER	Initial frequency for each block of data on UFTAPE (cm^{-1})
IPARAM(273)	INTEGER	Number of spectral data sets in each block of data on UFTAPE

UPRATM

This COMMON block contains the parameters for the upper model atmosphere profiles (i.e., above 120 km).

Common Block UPRATM used in:
EQABS EXOATM SETALT UPPRBD

Variable Name	Type	Description
ZU(NLUPR)	REAL	Altitude (km)
TSTD(NLUPR)	REAL	Standard temperature (K)
PSTD(NLUPR)	REAL	Standard pressure (mb)
TUS(NTEXO, NLUPR,3)	REAL	Seasonal temperatures (K) for a given exoatmospheric temperature
PUS(NTEXO, NLUPR,3)	REAL	Seasonal pressures (mb) for a given exoatmospheric pressure
TMPEXO(NTEXO)	REAL	Exoatmospheric temperatures (K) for TUS and PUS
TUX(NLUPR, MAXLAT,MAXLON)	REAL	Final temperatures (K) for upper atmosphere
PUX(NLUPR, MAXLAT,MAXLON)	REAL	Final pressures (mb) for upper atmosphere

USERDF

This COMMON block contains the parameters for the user-defined atmosphere model.

Common Block USERDF used in:

ASPECT DEFALT EQABS GETASP HAZE ISTAER
SETALT STRCN2 USRDEF

Variable Name	Type	Description
NLUSER	INTEGER	Number of altitudes
ZUSER(MLMAX)	REAL	Altitude (km)
INDXH	INTEGER	Index for user-defined haze profile
HZUSER(MLMAX)	REAL	User-defined haze profile (km^{-1})
INDXC	INTEGER	Index for user-defined structure constant profile
CN2USR(MLMAX)	REAL	User-defined structure constant profile ($m^{-2/3}$)
INDXA	INTEGER	Index for user-defined aerosol profile
IARUSR(MLMAX)	INTEGER	User-defined aerosol profile
NASUSR	INTEGER	Number of user-defined earth/skyshine elevation angles
ASPUSR(NASMAX)	REAL	User-defined earth/skyshine elevation angles (deg)
MPUSR	INTEGER	Index for user-defined pressure
PUSER(MLMAX)	REAL	User-defined pressure (mb)
MTUSR	INTEGER	Index for user-defined temperature
TUSER(MLMAX)	REAL	User-defined temperature (K)
MCUSR(ISMX)	INTEGER	Indices for user-defined molecular concentrations
AUSER(MLMAX, ISMX)	REAL	User-defined molecular concentrations (ppmv)
FLUSR	LOGICAL	Flag for completing profile with model atmosphere

USERNM

This COMMON block contains the user-defined atmosphere name.

Common Block USERNM used in:
USRDEF BBTEMP SUMFIL VISUAL

Variable Name	Type	Description
HMODEL	CHARACTER*40	User-defined atmosphere name

VSADTA

This COMMON block contains the parameters for the vertical structure profile of the aerosol density between 0 and 2 km above ground level.

Common Block VSADTA used in:

ENDPT EQABS EQUABS INITL TANGPT VSA

Variable Name	Type	Description
HMAX	REAL	Maximum altitude (km) at which vertical structure profile will be calculated. Default value is 2 km, unless unless cloud/fog top is lower.
ZVSA(NVSA, MAXLAT,MAXLON)	REAL	Altitude (km)
RHVSA(NVSA, MAXLAT,MAXLON)	REAL	Relative humidity
HZVSA(NVSA, MAXLAT,MAXLON)	REAL	Extinction coefficient (km^{-1}) at 0.55 μm

WETNES

This COMMON block contains the volumetric moisture for vegetation and soil.

Common Block WETNES used in:
DIREMS EMISBD

Variable Name	Type	Description
MV(13)	REAL	Volumetric moisture on vegetation and soil

WNLOHI

This COMMON block contains the spectral LOWTRAN band model coefficients.

Common Block WNLOHI used in:
LOWTRN WVBNBD

Variable Name	Type	Description
MVH2O	INTEGER	Number of water vapor bands
MVCO2	INTEGER	Number of carbon dioxide bands
MVO3	INTEGER	Number of ozone bands
MVN2O	INTEGER	Number of nitrous oxide bands
MVCO	INTEGER	Number of carbon monoxide bands
MVCH4	INTEGER	Number of methane bands
MVO2	INTEGER	Number of oxygen bands
MVSO2	INTEGER	Number of sulfur dioxide bands
MVNO2	INTEGER	Number of nitrogen dioxide bands
MVNO	INTEGER	Number of nitric oxide bands
MVNH3	INTEGER	Number of ammonia bands
IWLH2O(14)	INTEGER	Lower limit for water vapor band (cm^{-1})
IWLCO2(10)	INTEGER	Lower limit for carbon dioxide band (cm^{-1})
IWLO3(5)	INTEGER	Lower limit for ozone band (cm^{-1})
IWLN2O(11)	INTEGER	Lower limit for nitrous oxide band (cm^{-1})
IWLCO(3)	INTEGER	Lower limit for carbon monoxide band (cm^{-1})
IWLCH4(4)	INTEGER	Lower limit for methane band (cm^{-1})
IWLO2(6)	INTEGER	Lower limit for oxygen band (cm^{-1})
IWLSO2(4)	INTEGER	Lower limit for sulfur dioxide band (cm^{-1})
IWLNO2(3)	INTEGER	Lower limit for nitrogen dioxide band (cm^{-1})
IWLNO(1)	INTEGER	Lower limit for nitric oxide band (cm^{-1})
IWLNH3(2)	INTEGER	Lower limit for ammonia band (cm^{-1})
IWHH2O(14)	INTEGER	Upper limit for water vapor band (cm^{-1})
IWHCO2(10)	INTEGER	Upper limit for carbon dioxide band (cm^{-1})
IWHO3(5)	INTEGER	Upper limit for ozone band (cm^{-1})
IWHN2O(11)	INTEGER	Upper limit for nitrous oxide band (cm^{-1})
IWHCO(3)	INTEGER	Upper limit for carbon monoxide band (cm^{-1})
IWHCH4(4)	INTEGER	Upper limit for methane band (cm^{-1})

IWHO2(6)	INTEGER	Upper limit for oxygen band (cm^{-1})
IWHSO2(4)	INTEGER	Upper limit for sulfur dioxide band (cm^{-1})
IWHNO2(3)	INTEGER	Upper limit for nitrogen dioxide band (cm^{-1})
IWHNO(1)	INTEGER	Upper limit for nitric oxide band (cm^{-1})
IWHNH3(2)	INTEGER	Upper limit for ammonia band (cm^{-1})
ANH3(2)	REAL	Ammonia exponent
ACO2(10)	REAL	Carbon dioxide exponent
ACO(3)	REAL	Carbon monoxide exponent
ACH4(4)	REAL	Methane exponent
ANO2(3)	REAL	Nitrogen dioxide exponent
AN2O(11)	REAL	Nitrous oxide exponent
AO2(6)	REAL	Oxygen exponent
AO3(5)	REAL	Ozone exponent
ASO2(4)	REAL	Sulfur dioxide exponent
AH2O(14)	REAL	Water vapor exponent
ANO(1)	REAL	Nitric oxide exponent
AANH3(2)	REAL	Ammonia exponential sum fit term
BBNH3(2)	REAL	Ammonia exponential sum fit term
CCNH3(2)	REAL	Ammonia exponential sum fit term
AACO2(10)	REAL	Carbon dioxide exponential sum fit term
BBCO2(10)	REAL	Carbon dioxide exponential sum fit term
CCCO2(10)	REAL	Carbon dioxide exponential sum fit term
AACO(3)	REAL	Carbon monoxide exponential sum fit term
BBCO(3)	REAL	Carbon monoxide exponential sum fit term
CCCO(3)	REAL	Carbon monoxide exponential sum fit term
AACH4(4)	REAL	Methane exponential sum fit term
BBCH4(4)	REAL	Methane exponential sum fit term
CCCH4(4)	REAL	Methane exponential sum fit term
AANO2(3)	REAL	Nitrogen dioxide exponential sum fit term
BBNO2(3)	REAL	Nitrogen dioxide exponential sum fit term
CCNO2(3)	REAL	Nitrogen dioxide exponential sum fit term
AAN2O(11)	REAL	Nitrous oxide exponential sum fit term
BBN2O(11)	REAL	Nitrous oxide exponential sum fit term
CCN2O(11)	REAL	Nitrous oxide exponential sum fit term
AAO2(6)	REAL	Oxygen exponential sum fit term
BBO2(6)	REAL	Oxygen exponential sum fit term
CCO2(6)	REAL	Oxygen exponential sum fit term

AAO3(5)	REAL	Ozone exponential sum fit term
BBO3(5)	REAL	Ozone exponential sum fit term
CCO3(5)	REAL	Ozone exponential sum fit term
AASO2(4)	REAL	Sulfur dioxide exponential sum fit term
BBSO2(4)	REAL	Sulfur dioxide exponential sum fit term
CCSO2(4)	REAL	Sulfur dioxide exponential sum fit term
AAH2O(14)	REAL	Water vapor exponential sum fit term
BBH2O(14)	REAL	Water vapor exponential sum fit term
CCH2O(14)	REAL	Water vapor exponential sum fit term
AANO(1)	REAL	Nitric oxide exponential sum fit term
BBNO(1)	REAL	Nitric oxide exponential sum fit term
CCNO(1)	REAL	Nitric oxide exponential sum fit term
PH2O(14)	REAL	Water vapor pressure exponent
PCO2(10)	REAL	Carbon dioxide pressure exponent
PO3(5)	REAL	Ozone pressure exponent
PN2O(11)	REAL	Nitrous oxide pressure exponent
PCO(3)	REAL	Carbon monoxide pressure exponent
PCH4(4)	REAL	Methane pressure exponent
PO2(6)	REAL	Oxygen pressure exponent
PSO2(4)	REAL	Sulfur dioxide pressure exponent
PNO2(3)	REAL	Nitrogen dioxide pressure exponent
PNO(1)	REAL	Nitric oxide pressure exponent
PNH3(2)	REAL	Ammonia pressure exponent
TH2O(14)	REAL	Water vapor temperature exponent
TCO2(10)	REAL	Carbon dioxide temperature exponent
TO3(5)	REAL	Ozone temperature exponent
TN2O(11)	REAL	Nitrous oxide temperature exponent
TCO(3)	REAL	Carbon monoxide temperature exponent
TCH4(4)	REAL	Methane temperature exponent
TO2(6)	REAL	Oxygen temperature exponent
TSO2(4)	REAL	Sulfur dioxide temperature exponent
TNO2(3)	REAL	Nitrogen dioxide temperature exponent
TNO(1)	REAL	Nitric oxide temperature exponent
TNH3(2)	REAL	Ammonia temperature exponent

ZODBND

This COMMON block contains the zodiacal light parameters.

Common Block ZODBND used in:
DBANDS ZOD2BD

Variable Name	Type	Description
NPTZOD(3)	INTEGER	Number of points in each band
TMPZOD(3)	REAL	Temperature of dust (K)
ALBEDO(3)	REAL	Albedo of dust
TAU(3)	REAL	
OMEGA(3)	REAL	
XIF(3)	REAL	
DEL(3)	REAL	
Q(3)	REAL	
THEMIS(811)	REAL	
KRONIS(632)	REAL	
EOS(632)	REAL	

ZPLANE

This COMMON block contains the zodiacal symmetry plane parameters.

Common Block ZPLANE used in:
ZOD2BD ZODICL

Variable Name	Type	Description
ZNODE	REAL	Ascending node (deg)
ZINC	REAL	Inclination (deg)
ZN	REAL	Normalized dust density at 1 AU (particles/m^3)
ZALPHA	REAL	Radial dependence factor

6.0 PARAMETER DATA DICTIONARY

The description and value of each PARAMETER variable, in addition to the modules in which it is contained, are presented in Table 1. All PARAMETER variables are declared INTEGER.

Table 1. PARAMETER Variables.

PARAMETER	VALUE	DESCRIPTION
MOLMAX	26	Number of different band molecules whose band model parameters can be read in
ISMX	MOLMAX+ 8	Number of species used in calculations
ISTMAX	30000	Maximum size of a COMMON block for raypath parameters
MLMAX	140	Maximum number of altitude points
MLMX2	2*MLMAX	Maximum number of points for a ray
NASMAX	15	Maximum number of earth/skyshine aspect angles
NAZMAX	30	Maximum number of observer-source azimuths
NBAND	16	Maximum number of elements in exponential sum expansion for multiple scattering
NFRQ	76	Number of frequency values in microwave water refractivity data base
NGAS	6	Number of molecules in plume binary data file
NGMAX	15	Maximum number of geometries
NMATL	28	Maximum number of background materials
NNNMAX	5	Number of line groups used for SIRRM calculations
NSCEN	42	Maximum number of background scenes

Table 1. PARAMETER Variables (continued).

PARAMETER	VALUE	DESCRIPTION
NTIME	500	Maximum number of time increments for heat transfer data base
NWLWTR	169	Number of spectral water refractivity data base
NXMIE	101	Maximum number of bins for particle size distribution for Mie calculations
NZSMAX	4	Maximum number of earth/skyshine azimuth angles
NXMAX	100	Maximum number of extra altitudes
NANTMX	125	Maximum number of antecedent temporal points
NVSA	9	Number of altitude points for Vertical Structure Algorithm
NWLCLD	79	Number of spectral points for hydrometeors
NWLAER	47	Number of spectral points for aerosols
NSTTMP	16	Number of stratospheric aerosol temperatures
NANG	65	Number of scattering angles for phase function
NL	50	Number of altitude layers in model atmospheres
NLUPR	8	Number of altitude layers in upper atmosphere profiles
NTEXO	11	Number of exospheric temperature profiles
MAXLAT	3	Maximum number of latitudes used for global atmosphere
MAXLON	1	Maximum number of longitudes used for global atmosphere
NVSMAX	20	Maximum number of spectral bands

Table 1. PARAMETER Variables (continued).

PARAMETER	VALUE	DESCRIPTION
NLMAX	10	Maximum number of subsurface layers for background temperature calculations
NZBNDR	3	Number of altitudes in the boundary layer haze profiles
NZTROP	9	Number of altitudes in the troposphere haze profiles
NZSTRA	17	Number of altitudes in the stratospheric haze profiles
NZUPR	14	Number of altitudes in the upper atmosphere haze profiles
MLIDMX	45	Number of molecular species that MOSART recognizes
NSMX	MLIDMX+8	Number of species that MOSART recognizes
NDV	200	Maximum number of spectral points used in slit function convolutions
NSLTD (in ASCBIN)	5	Maximum number of variables to be convolved
NSLTD (in PLTGEN)	3* NAZMAX* (1+ISMX)	Maximum number of variables to be convolved
MLUSR	34	Maximum number of user-defined altitudes for MODTRAN input file
MAXTMP	5	Number of temperatures in band model parameters
NMAX (in ABSO3)	3080	Number of spectral points for ozone band model
NMAX (in ABSSO2)	5562	Number of spectral points for sulfur dioxide band model

Table 1. PARAMETER Variables (continued).

PARAMETER	VALUE	DESCRIPTION
NMAX (in MIE)	20000	Maximum number of bins for integrating over the size distribution
NPTS (in DENWTR)	56	Number of temperature values
NPTS (in ENDPD)	2000	Maximum number of intermediate altitudes
NPTS (in EVAPOR)	18	Number of temperature values
NPTS (in EXGALS)	7	Number of spectral values
NPTS (in SCINTL)	10	Number of scintillation levels
MPTS (in SCINTL)	14	Number of aperture diameters
MPTS (in COLOR)	83	Number of spectral values in CIE color curves
NPMAX	250	Maximum number of spectral points in a MODTRAN data base logical record
NTMPMX	5	Number of temperature values in the MODTRAN data base
MXLNRC	16384	Maximum length for a direct access logical record
NLINES	10	Number of logical records used to evaluate writing and reading direct access file
NUMPTS	3000	Maximum number of spectral points in a curve segment
NUMCRV	5	Maximum number of curve segments in a plot
NLAYER	20	Number of layers in subsurface heat conduction calculation

Table 1. PARAMETER Variables (continued).

PARAMETER	VALUE	DESCRIPTION
NTEMP	5	Number of temperatures in band parameter data bases
NWL	29	Number of spectral points for hydrogen peroxide band model
NVMAX (in AMMNIA)	11	Number of spectral points for ammonia band model
NVMAX (in VISUAL)	3600	Number of spectral points that can be read in VISUAL
NVAR6	6	Number of years of historical data
NYR1	44	Number of years of long-term historical CO_2 data (1743-1959)
NYR2	258	Number of recent CO_2 measurements
NYRMAX	175	Number of years for the conversion of UT to Ephemeris Time
NWLMX	100	Maximum number of spectral points in user-defined aerosol
NALB	30	Number of spectral values of lunar albedo
NEL	37	Number of values for variations in lunar irradiance due to phase
NBIN	21	Number of bins for integration over snow size distribution
NSPH (in SPHICE)	11	Number of temperatures in specific heat of ice calculation
NSPH (in SPHWTR)	19	Number of temperatures in specific heat of water calculations
NAIT	10	Maximum number of points for an Aitken iterated polynomial interpolation

7.0 CALLING STRUCTURE

The calling structure (i.e., which routine calls which other routines and which routines are called by a routine) is provided below, together with the prerequisite calling order of each program, and the COMMON block reference list.

7.1 MOSART

7.1.1 MOSART Subprogram References

```
MOSART calls:
       CALCUL       CNSTNT       CONFIG       DBINIT       EPHEMS       EQUABS
        INITL        IOERR       PROMPT       RDFLTR        SLPOS       TITLCR
CALCUL calls:
       BRBNDR       INDXBK        IOERR       OPNSCR       PRCALC       PUTHDR
       RESOLV       SCNRIO       SETBCK       SRCFLX       SRCGEO       SRCIRR
       SUMFIL
BRBNDR calls:
       AECALC       AIRTMP       BBARSL       EPHEMS       FLUXLW       HTBLNC
        IOERR        OPATH       PRETEM        SATUR       SEATMP       SLRCNT
       SOLBND       SPCLYR        XTERP
AECALC calls:
       PLANCK
PLANCK calls: none
AIRTMP calls: none
BBARSL calls:
       PLANCK        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
EPHEMS calls:
       EPHEML       EPHTIM       PLANET        SLPOS       SPTRIG
EPHEML calls: none
EPHTIM calls: none
PLANET calls: none
SLPOS calls:
         GEOM       HORIZN
GEOM calls:
        ENDPT       INIGEO       RAYPTH
ENDPT calls:
       AERSOL        EQABS         HAZE       HYDROM       ISTAER       STRCN2
        XTERP
AERSOL calls:
       DESAER       MARINE       MIEPHS       PROFAC        XTERP
DESAER calls: none
MARINE calls:
       PROFAC
PROFAC calls:
       IBNSRC
MIEPHS calls:
         COAT         DNDR       EMTREF       INDEXI       INDEXW          MIE
       PROFAC
COAT calls:
       NCYCLE
NCYCLE calls: none
DNDR calls:
       GAMMLN
GAMMLN calls: none
```

```
EMTREF calls: none
INDEXI calls:
        XTERP
INDEXW calls:
        XTERP
MIE calls:
       NCYCLE
EQABS calls:
       BNDMLG       MDLATM       PARTIT       REFRAC       RELHUM       SATUR
        XTERP
BNDMLG calls: none
MDLATM calls: none
PARTIT calls: none
REFRAC calls:
          PFR         SUPK
PFR calls: none
SUPK calls: none
RELHUM calls:
        SATUR
SATUR calls: none
HAZE calls:
        HLOWT        XTERP
HLOWT calls: none
HYDROM calls:
        CIREX        PROFAC       RAINEX       SATUR        SNOWEX       XTERP
CIREX calls: none
RAINEX calls: none
SNOWEX calls: none
ISTAER calls:
        HLOWT
STRCN2 calls:
       REFRAC        XTERP
INIGEO calls: none
RAYPTH calls:
       TANGPT
TANGPT calls:
       AERSOL        EQABS        HAZE         HYDROM       ISTAER       STRCN2
        XTERP
HORIZN calls:
       RAYPTH
SPTRIG calls: none
FLUXLW calls: none
HTBLNC calls:
       SRFLUX
SRFLUX calls:
       EVAPOR        SATUR
EVAPOR calls:
        XTERP
IOERR calls:
       GERROR
GERROR calls: none
OPATH calls:
        LAYLW        SATUR        TRANLW
LAYLW calls: none
TRANLW calls: none
PRETEM calls: none
SEATMP calls: none
SLRCNT calls: none
SOLBND calls:
          BBO3       CLDLYR       SRAT         SRTLAY       SWAT         UDLAY
BBO3 calls: none
CLDLYR calls:
          BETA        BETAU
BETA calls: none
BETAU calls: none
```

```
SRAT calls: none
SRTLAY calls:
        BETA
SWAT calls:
        DDIF          GAM          RAB          RBE          UDIF
DDIF calls: none
GAM calls: none
RAB calls: none
RBE calls: none
UDIF calls: none
UDLAY calls: none
SPCLYR calls:
       DENAIR       DENWTR       SPHAIR       SPHICE       SPHWTR       THCAIR
       THCICE       THCSNW       THCWTR
DENAIR calls:
       VIRIAL
VIRIAL calls:
        XTERP
DENWTR calls: none
SPHAIR calls: none
SPHICE calls:
        XTERP
SPHWTR calls:
        XTERP
THCAIR calls: none
THCICE calls:
        XTERP
THCSNW calls: none
THCWTR calls:
        XTERP
INDXBK calls:
       GBLBCK
GBLBCK calls:
       AIRTMP        RDGBL        RDSCN
RDGBL calls:
        IOERR       SEAICE
SEAICE calls: none
RDSCN calls:
       CITIES       IBKCNV        IOERR
CITIES calls: none
IBKCNV calls: none
OPNSCR calls:
        IOERR
PRCALC calls:
       ATMPRN       BCKGND       BCKPRN       BNDPAR       BNTPTH       COUPLE
       DISPRN        DPLDT       FILTER       INDXBK        INTEG        IOERR
       KDISTR       MLSCAT       PLANCK       PLMSUB       PTHOSB       PTHTAU
       RESOLV       RSHINE       SCINTL       SLUNAR       SMPCAL        SOLAR
       SOLRAD       TERMPR       XPNDAR       ZROINT
ATMPRN calls:
       INDXBK        IOERR        PRALT       RELHUM       SETBCK
PRALT calls:
       IBNSRC
SETBCK calls:
       INTR2D       MODBCK
INTR2D calls: none
MODBCK calls: none
BCKGND calls:
         BDRF       DEMSXX       EMTREF       EXGALS       FRESNL       GALRAD
       INDEXI       INDEXW       PLANCK       REFEST       SETBCK       SLUNAR
        SOLAR       STARAD        XTERP       ZODICL
BDRF calls:
       DIREFL       SHADOW
DIREFL calls: none
```

```
SHADOW calls:
        DERF
DERF calls: none
DEMSXX calls:
       DIREMS       EMTREF       INDEXI       INDEXW       SEAWTR       SOIL
DIREMS calls:
       EHBSL0       FRESNL       PLANCK
EHBSL0 calls:
         POLY
POLY calls: none
FRESNL calls: none
SEAWTR calls: none
SOIL calls: none
EXGALS calls:
       PLANCK        XTERP
GALRAD calls:
       PLANCK
REFEST calls: none
SLUNAR calls:
        SOLAR        XTERP
SOLAR calls:
         EVEN
EVEN calls: none
STARAD calls:
       PLANCK
ZODICL calls:
       DBANDS       EMISSV       EPHTIM       GETGLC
DBANDS calls:
       PLANCK        SOLAR         ZLAT
ZLAT calls: none
EMISSV calls:
       PLANCK        SOLAR
GETGLC calls: none
BCKPRN calls:
        IOERR
BNDPAR calls:
       AMOLSC         BMOD       PHFUNC       PHMLSC       RAINSP       SNOWSP
        XTERP
AMOLSC calls:
        DEPOL       REFRAC
DEPOL calls:
        XTERP
BMOD calls:
       ABCCL4       ABHNO4       ABN2O5       ABSCFC       ABSCLO       ABSH2O
       ABSMOL        ABSN2       ABSN2O       ABSNO2        ABSO2        ABSO3
       ABSSO2        AH2O2       AMMNIA         EVEN       H2OCNT       O2CNT
       PARTIT       PROFAC       RADFLD
ABCCL4 calls:
        XTERP
ABHNO4 calls:
        XTERP
ABN2O5 calls:
        XTERP
ABSCFC calls:
        XTERP
ABSCLO calls:
        XTERP
ABSH2O calls: none
ABSMOL calls:
        IOERR
ABSN2 calls: none
ABSN2O calls: none
ABSNO2 calls: none
ABSO2 calls:
        XTERP
```

```
ABSO3 calls: none
ABSSO2 calls: none
AH2O2 calls:
        XTERP
AMMNIA calls: none
H2OCNT calls: none
O2CNT calls: none
RADFLD calls: none
PHFUNC calls:
       CSPHFN        PHYDRO        PROFAC
CSPHFN calls: none
PHYDRO calls:
       CSPHFN        PROFAC         XTERP
PHMLSC calls:
        DEPOL
RAINSP calls:
       PROFAC         XTERP
SNOWSP calls:
       PROFAC
BNTPTH calls: none
COUPLE calls:
       BCKGND        INICPL        PROFAC         XTERP
INICPL calls:
         BETA         BETAU         ESFIT        SRTLAY         UDLAY
ESFIT calls: none
DISPRN calls:
        IOERR
DPLDT calls: none
FILTER calls:
        XTERP
INTEG calls: none
KDISTR calls: none
MLSCAT calls:
        BETAU        RADTRY
RADTRY calls: none
PLMSUB calls:
       COMFNC
COMFNC calls: none
PTHOSB calls:
       RADTRX
RADTRX calls: none
PTHTAU calls:
       BNTPTH        TRNSMT
TRNSMT calls:
         BAND
BAND calls:
         DERF
RESOLV calls:
       DVINCR
DVINCR calls: none
RSHINE calls:
       BCKGND        BNTPTH         IOERR        MLSCAT        PTHTAU        RADTRX
       SOLRAD        TERMPR
SOLRAD calls:
       PTHTAU        RADTRY         XTERP
TERMPR calls:
       SHADOW
SCINTL calls:
       PROFAC         XTERP
SMPCAL calls:
       PTHTAU
XPNDAR calls:
        XTERP
ZROINT calls: none
```

```
PUTHDR calls:
        IOERR       PRTHDR
PRTHDR calls:
        IOERR
SCNRIO calls:
       CALEND       DEFBCK      ECLGAL      EQUECL        GEOM       HOREQU
       HORIZN       INTR2D      RAYPTH      SHNGEO      SPTRIG       TURBUL
CALEND calls: none
DEFBCK calls:
       BCKCHK       INDXBK      SETBCK      SPTRIG
BCKCHK calls: none
ECLGAL calls: none
EQUECL calls: none
HOREQU calls: none
SHNGEO calls:
       HOREQU       INTR2D      RAYPTH      SPTRIG
TURBUL calls: none
SRCFLX calls: none
SRCGEO calls:
         GEOM       HORIZN      INTR2D      SPTRIG
SRCIRR calls:
       ASPECT       CALEND      ECLGAL      EQUECL      HOREQU      HORIZN
       INDXBK       INTR2D       IOERR      RAYPTH       SETUP      SHNGEO
       SPTRIG
ASPECT calls:
       GETGLC
SETUP calls: none
SUMFIL calls:
       CHTIME        IOERR      LENSTR      PUTCLD      PUTSLR
CHTIME calls: none
LENSTR calls: none
PUTCLD calls:
        IOERR
PUTSLR calls:
        IOERR       SLRCNT
CNSTNT calls:
          ADD         DADD        DDIV         DIV        DMUL        DSUB
          MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
DBINIT calls:
        IOERR
EQUABS calls:
       AERSOL       CHANGE      CLDALT       EQABS        HAZE       HEYMS
        HLOWT       HYDROM       IOERR      ISTAER      NXXPAU      SETALT
       SKYNOI       STRCN2       VISRH       XTERP
CHANGE calls:
        XTERP
CLDALT calls:
        RDGBL       TMPCLD
TMPCLD calls: none
HEYMS calls: none
NXXPAU calls:
       IBNSRC       PROFAC      XTERP
SETALT calls:
        XTERP
SKYNOI calls:
       REFRAC
```

```
VISRH calls: none
INITL calls:
       BEAUFT       BINFIL       CALEND       CIRRUS       DEFALT        DFLT2
        DFLT8       EXOATM       EXOTMP       FILOPN        FILRT       GBLBCK
       GETASP       GETATM       GETBCK       GETCLD       GETEXO       GETPOS
       GETSLR       GETVAR       GETVEC        IOERR       ISRAEL       LWCASE
       MDLATM       MIEINP        PARSE       RDLINE        SATUR       SETFLG
       STGEOM       UPCASE       USRDEF          VSA       ZROHDR
BEAUFT calls: none
BINFIL calls:
       CHKRST       CHKVER       DISEND       FLSTAT        IOERR       RDLINE
       UPCASE
CHKRST calls:
        IOERR
CHKVER calls:
        IOERR
DISEND calls:
        IOERR
FLSTAT calls:
        IOERR       UPCASE
UPCASE calls: none
RDLINE calls:
        IOERR       LCTRIM       LENSTR
LCTRIM calls: none
CIRRUS calls: none
DEFALT calls:
       EXOATM       GBLBCK
EXOATM calls:
        XTERP
DFLT2 calls:
       IDAERO       MDLATM
IDAERO calls: none
DFLT8 calls:
       DVINCR       GETVEC       RDLINE       UPCASE
GETVEC calls:
        IOERR       LCTRIM       LENSTR
EXOTMP calls: none
FILOPN calls:
        IOERR       RDLINE       UPCASE
FILRT calls:
       LCTRIM
GETASP calls:
       GETVEC       IGTINT       RDLINE       UPCASE
IGTINT calls:
        IOERR
GETATM calls:
       GETVAR       IGTINT       IGTVEC       LWCASE       MRNDFL       NCHAER
       NCHATM       NCHAZE       NCHSEA       RDLINE       UPCASE
GETVAR calls:
        IOERR
IGTVEC calls:
        IOERR       LCTRIM       LENSTR
LWCASE calls: none
MRNDFL calls: none
NCHAER calls:
       LCTRIM       UPCASE
NCHATM calls:
       LCTRIM       UPCASE
NCHAZE calls:
       LCTRIM       UPCASE
NCHSEA calls:
       LCTRIM       UPCASE
GETBCK calls:
       GETVAR       GETVEC       IGTINT       RDLINE       UPCASE       USRBCK
```

```
USRBCK calls:
       GETVAR        GETVEC        IGTINT        IGTVEC        IOERR         PARSE
       RDLINE        UPCASE
PARSE calls:
       LCTRIM        LENSTR
GETCLD calls:
       GETVAR        IGTINT        RDLINE        UPCASE        USRCLD
USRCLD calls:
       GETVAR        IGTINT         IOERR         PARSE        RDLINE        UPCASE
GETEXO calls:
       GETVAR        IGTINT         PARSE        RDLINE        UPCASE
GETPOS calls:
       CALEND        CHTIME        GETVAR        IGTINT        LWCASE        MONTH
       RDLINE        UPCASE
MONTH calls:
       LCTRIM        UPCASE
GETSLR calls:
       GETVAR        RDLINE        SPTRIG        UPCASE
ISRAEL calls: none
MIEINP calls:
       GETVAR        GETVEC        IGTINT         IOERR        LWCASE        PARSE
       RDLINE        UPCASE
SETFLG calls: none
STGEOM calls:
       GETVAR        IGTINT        LWCASE        UPCASE
USRDEF calls:
       GBLBCK        GETVAR        IGTINT         IOERR        LWCASE        MDLATM
        PARSE        RDLINE        UPCASE        XMCONV         XTERP
XMCONV calls:
        SATUR         XTERP
VSA calls: none
ZROHDR calls: none
PROMPT calls: none
RDFLTR calls:
       GETVAR         IOERR        LCTRIM        LENSTR        LWCASE        PARSE
       RDLINE        UPCASE
TITLCR calls:
        FDATE
FDATE calls: none
```

7.1.2 MOSART Cross-Reference List

```
ABCCL4 called by:
         BMOD
ABHNO4 called by:
         BMOD
ABN2O5 called by:
         BMOD
ABSCFC called by:
         BMOD
ABSCLO called by:
         BMOD
ABSH2O called by:
         BMOD
ABSMOL called by:
         BMOD
ABSN2 called by:
         BMOD
ABSN2O called by:
         BMOD
ABSNO2 called by:
         BMOD
ABSO2 called by:
         BMOD
```

```
ABSO3 called by:
         BMOD
ABSSO2 called by:
         BMOD
ADD called by:
        CNSTNT
AECALC called by:
        BRBNDR
AERSOL called by:
         ENDPT        EQUABS       TANGPT
AH2O2 called by:
         BMOD
AIRTMP called by:
        BRBNDR        GBLBCK
AMMNIA called by:
         BMOD
AMOLSC called by:
        BNDPAR
ARSABD called by:
        AERSOL        HYDROM       MARINE
ARSLBD called by:
        AERSOL        BBARSL       BNDPAR       HYDROM       MARINE       PHFUNC
        PHYDRO        PRCALC       RSHINE
ARSXBD called by:
        AERSOL        HYDROM       MARINE
ASPECT called by:
        SRCIRR
ATMPRN called by:
        PRCALC
ATMSBD called by:
        ATMPRN        BCKPRN       BRBNDR       CALCUL        DFLT2        EQABS
        EQUABS        GBLBCK        INITL       PRCALC       SCNRIO       SETALT
        SETBCK        SHNGEO       SRCGEO       SRCIRR       USRDEF
BAND called by:
        TRNSMT
BBARSL called by:
        BRBNDR
BBO3 called by:
        SOLBND
BCKCHK called by:
        DEFBCK
BCKGND called by:
        COUPLE        PRCALC       RSHINE
BCKPRN called by:
        PRCALC
BDRF called by:
        BCKGND
BEAUFT called by:
         INITL
BETA called by:
        CLDLYR        INICPL       SRTLAY
BETAU called by:
        CLDLYR        INICPL       MLSCAT
BINFIL called by:
         INITL
BKGDBD called by:
        ATMPRN        BCKGND       BRBNDR       COUPLE       GETBCK       INITL
        SETBCK        SPCLYR       USRBCK
BKSTBD called by:
        AERSOL        PHFUNC
BMOD called by:
        BNDPAR
BNDMLG called by:
         EQABS
```

```
BNDPAR called by:
       PRCALC
BNTPTH called by:
       PRCALC        PTHTAU        RSHINE
BRBNBD called by:
       CLDLYR        FLUXLW        SOLBND        TRANLW
BRBNDR called by:
       CALCUL
CALCUL called by:
       MOSART
CALEND called by:
       GETPOS         INITL        SCNRIO        SRCIRR
CFCBD called by:
       ABSCFC
CHANGE called by:
       EQUABS
CHKRST called by:
       BINFIL
CHKVER called by:
       BINFIL
CHRCBD called by:
       ATMPRN        BRBNDR        EQUABS        PUTCLD        SUMFIL        USRBCK
CHTIME called by:
       GETPOS        SUMFIL
CIREX called by:
       HYDROM
CIRRBD called by:
       PHYDRO
CIRRUS called by:
        INITL
CITIES called by:
        RDSCN
CLDALT called by:
       EQUABS
CLDLYR called by:
       SOLBND
CLDRBD called by:
        ENDPT        EQUABS        HYDROM        PUTCLD        RAINSP        TANGPT
       USRCLD
CNSTNT called by:
       MOSART
COAT called by:
       MIEPHS
COMFNC called by:
       PLMSUB
CONFIG called by:
       MOSART
COUPLE called by:
       PRCALC
CROSBD called by:
       ABCCL4        ABHNO4        ABN2O5        ABSCLO
CSPHFN called by:
       PHFUNC        PHYDRO
DADD called by:
       CNSTNT
DBANDS called by:
       ZODICL
DBINIT called by:
       MOSART
DDIF called by:
         SWAT
DDIV called by:
       CNSTNT
DEFALT called by:
        INITL
```

```
DEFBCK called by:
       SCNRIO
DEMSXX called by:
       BCKGND
DENAIR called by:
       SPCLYR
DENWTR called by:
       SPCLYR
DEPOL called by:
       AMOLSC        PHMLSC
DERF called by:
         BAND        SHADOW
DESAER called by:
       AERSOL
DEVCBD called by:
       ABSMOL        ATMPRN        BCKPRN        BRBNDR        CALCUL        DBINIT
       DEFALT         DFLT8        EQUABS         FILRT        FLSTAT        GBLBCK
       GETASP        GETATM        GETBCK        GETCLD        GETEXO        GETPOS
       GETSLR         INITL        MIEINP        MOSART        PRCALC        PUTCLD
       PUTHDR        PUTSLR        RDFLTR         RDGBL         RDSCN        SUMFIL
       USRBCK        USRCLD
DFLT2 called by:
        INITL
DFLT8 called by:
        INITL
DIREFL called by:
         BDRF
DIREMS called by:
       DEMSXX
DISEND called by:
       BINFIL
DISPRN called by:
       PRCALC
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DNDR called by:
       MIEPHS
DPLDT called by:
       PRCALC
DSRTBD called by:
       DESAER
DSUB called by:
       CNSTNT
DVINCR called by:
        DFLT8        RESOLV
ECLGAL called by:
       SCNRIO        SRCIRR
ECOSBD called by:
       IBKCNV
EHBSL0 called by:
       DIREMS
EMISBD called by:
       DEMSXX          SOIL
EMISSV called by:
       ZODICL
EMTREF called by:
       BCKGND        DEMSXX        MIEPHS
ENDPT called by:
         GEOM
EPHEML called by:
       EPHEMS
EPHEMS called by:
       BRBNDR        MOSART
```

```
EPHTIM called by:
       EPHEMS        ZODICL
EQABS called by:
        ENDPT        EQUABS        TANGPT
EQUABS called by:
       MOSART
EQUECL called by:
       SCNRIO        SRCIRR
ESFIT called by:
       INICPL
EVAPOR called by:
       SRFLUX
EVEN called by:
         BMOD         SOLAR
EXGALS called by:
       BCKGND
EXMLBD called by:
         EQABS        USRDEF
EXOATM called by:
       DEFALT         INITL
EXOTMP called by:
         INITL
FDATE called by:
       TITLCR
FILOPN called by:
         INITL
FILRT called by:
         INITL
FILTER called by:
       PRCALC
FLSTAT called by:
       BINFIL
FLUXLW called by:
       BRBNDR
FRESNL called by:
       BCKGND        DIREMS
GALRAD called by:
       BCKGND
GAM called by:
          SWAT
GAMMLN called by:
          DNDR
GBLBCK called by:
       DEFALT        INDXBK         INITL        USRDEF
GEOM called by:
       SCNRIO         SLPOS        SRCGEO
GERROR called by:
         IOERR
GETASP called by:
         INITL
GETATM called by:
         INITL
GETBCK called by:
         INITL
GETCLD called by:
         INITL
GETEXO called by:
         INITL
GETGLC called by:
       ASPECT        ZODICL
GETPOS called by:
         INITL
GETSLR called by:
         INITL
```

```
GETVAR called by:
       GETATM       GETBCK       GETCLD       GETEXO       GETPOS       GETSLR
        INITL       MIEINP       RDFLTR       STGEOM       USRBCK       USRCLD
       USRDEF
GETVEC called by:
        DFLT8       GETASP       GETBCK        INITL       MIEINP       USRBCK
GLCFBD called by:
       GETGLC
H2OBD called by:
       H2OCNT
H2OCNT called by:
         BMOD
HAZE called by:
        ENDPT       EQUABS       TANGPT
HAZEBD called by:
         HAZE
HEYMS called by:
       EQUABS
HLOWT called by:
       EQUABS         HAZE       ISTAER
HOREQU called by:
       SCNRIO       SHNGEO       SRCIRR
HORIZN called by:
       SCNRIO        SLPOS       SRCGEO       SRCIRR
HTBLNC called by:
       BRBNDR
HYDROM called by:
        ENDPT       EQUABS       TANGPT
IBKCNV called by:
        RDSCN
IBNSRC called by:
       BNDPAR       NXXPAU        PRALT       PROFAC        XTERP
ICEBD called by:
       INDEXI
IDAERO called by:
        DFLT2
IGTINT called by:
       GETASP       GETATM       GETBCK       GETCLD       GETEXO       GETPOS
       MIEINP       STGEOM       USRBCK       USRCLD       USRDEF
IGTVEC called by:
       GETATM       USRBCK
INDEXI called by:
       BCKGND       DEMSXX       MIEPHS
INDEXW called by:
       BCKGND       DEMSXX       MIEPHS
INDXBK called by:
       ATMPRN       CALCUL       DEFBCK       PRCALC       SRCIRR
INFLBD called by:
       RDFLTR
INICPL called by:
       COUPLE
INIGEO called by:
          GEOM
INITL called by:
       MOSART
INPTBD called by:
        INITL
INTEG called by:
       PRCALC
INTR2D called by:
       SCNRIO       SETBCK       SHNGEO       SRCGEO       SRCIRR
```

```
IOERR called by:
       ABSMOL       ATMPRN       BCKPRN       BINFIL       BRBNDR       CALCUL
       CHKRST       CHKVER       DBINIT       DISEND       DISPRN       EQUABS
       FILOPN       FLSTAT       GETVAR       GETVEC       IGTINT       IGTVEC
        INITL       MIEINP       MOSART       OPNSCR       PRCALC       PRTHDR
       PUTCLD       PUTHDR       PUTSLR       RDFLTR        RDGBL       RDLINE
        RDSCN       RSHINE       SRCIRR       SUMFIL       USRBCK       USRCLD
       USRDEF
ISRAEL called by:
        INITL
ISTAER called by:
        ENDPT       EQUABS       TANGPT
KDISTR called by:
       PRCALC
LAGRBD called by:
        ESFIT
LAYLW called by:
        OPATH
LCTRIM called by:
        FILRT       GETVEC       IGTVEC        MONTH       NCHAER       NCHATM
       NCHAZE       NCHSEA        PARSE       RDFLTR       RDLINE
LENSTR called by:
       GETVEC       IGTVEC        PARSE       RDFLTR       RDLINE       SUMFIL
LUNPBD called by:
       EPHEML
LWCASE called by:
       GETATM       GETPOS        INITL       MIEINP       RDFLTR       STGEOM
       USRDEF
MARINE called by:
       AERSOL
MARNBD called by:
       MARINE
MDLATM called by:
        DFLT2        EQABS        INITL       USRDEF
MIE called by:
       MIEPHS
MIEINP called by:
        INITL
MIEPHS called by:
       AERSOL
MLSCAT called by:
       PRCALC       RSHINE
MODBCK called by:
       SETBCK
MOLPBD called by:
          BMOD       BNDPAR       BRBNDR       DENAIR        ENDPT        EQABS
       EQUABS       PARTIT       PLMSUB       PRCALC       PRETEM       PUTHDR
       SCNRIO       TANGPT       XMCONV
MONTH called by:
       GETPOS
MOSART not called
MRNDFL called by:
       GETATM
MUL called by:
       CNSTNT
NCHAER called by:
       GETATM
NCHATM called by:
       GETATM
NCHAZE called by:
       GETATM
NCHSEA called by:
       GETATM
NCYCLE called by:
         COAT         MIE
```

```
NO2BD called by:
       ABSNO2
NXXPAU called by:
       EQUABS
O2CBD called by:
        O2CNT
O2CNT called by:
         BMOD
O2UVBD called by:
        ABSO2
O3CWBD called by:
        ABSO3
O3HHBD called by:
        ABSO3
OCNTBD called by:
       SEATMP
OPATH called by:
       BRBNDR
OPNSCR called by:
       BNDPAR       CALCUL
PARSE called by:
       GETEXO        INITL       MIEINP       RDFLTR       USRBCK       USRCLD
       USRDEF
PARTIT called by:
         BMOD        EQABS
PFR called by:
       REFRAC
PHFGBD called by:
       PHFUNC
PHFUNC called by:
       BNDPAR
PHHYBD called by:
       PHYDRO
PHMABD called by:
       PHFUNC
PHMLSC called by:
       BNDPAR
PHOCBD called by:
       PHFUNC
PHRUBD called by:
       PHFUNC
PHSTBD called by:
       PHFUNC
PHTRBD called by:
       PHFUNC
PHURBD called by:
       PHFUNC
PHYDRO called by:
       PHFUNC
PLANCK called by:
       AECALC       BBARSL       BCKGND       DBANDS       DIREMS       EMISSV
       EXGALS       GALRAD       PRCALC       STARAD
PLANET called by:
       EPHEMS
PLMSUB called by:
       PRCALC
POLY called by:
       EHBSL0
PRALT called by:
       ATMPRN
PRCALC called by:
       CALCUL
PRETEM called by:
       BRBNDR
```

PROFAC called by:
AERSOL BMOD COUPLE HYDROM MARINE MIEPHS
NXXPAU PHFUNC PHYDRO RAINSP SCINTL SNOWSP
PROMPT called by:
MOSART
PRTHDR called by:
PUTHDR
PTHOSB called by:
PRCALC
PTHTAU called by:
PRCALC RSHINE SMPCAL SOLRAD
PUTCLD called by:
SUMFIL
PUTHDR called by:
CALCUL
PUTSLR called by:
SUMFIL
RAB called by:
SWAT
RADFLD called by:
BMOD
RADTRX called by:
PTHOSB RSHINE
RADTRY called by:
MLSCAT SOLRAD
RAINBD called by:
RAINEX RAINSP SNOWSP
RAINEX called by:
HYDROM
RAINSP called by:
BNDPAR
RAYPTH called by:
GEOM HORIZN SCNRIO SHNGEO SRCIRR
RBE called by:
SWAT
RDFLTR called by:
MOSART
RDGBL called by:
CLDALT GBLBCK
RDLINE called by:
BINFIL DFLT8 FILOPN GETASP GETATM GETBCK
GETCLD GETEXO GETPOS GETSLR INITL MIEINP
RDFLTR USRBCK USRCLD USRDEF
RDSCN called by:
GBLBCK
REFEST called by:
BCKGND
REFRAC called by:
AMOLSC EQABS SKYNOI STRCN2
REFRBD called by:
REFRAC
RELHUM called by:
ATMPRN EQABS
RESOLV called by:
CALCUL PRCALC
RSHINE called by:
PRCALC
SATUR called by:
BRBNDR EQABS HYDROM INITL OPATH RELHUM
SRFLUX XMCONV
SCENBD called by:
ATMPRN SETBCK TERMPR USRBCK
SCINTL called by:
PRCALC

```
SCNRIO called by:
       CALCUL
SEAICE called by:
        RDGBL
SEATMP called by:
       BRBNDR
SEAWTR called by:
       DEMSXX
SETALT called by:
       EQUABS
SETBCK called by:
       ATMPRN        BCKGND        CALCUL        DEFBCK
SETFLG called by:
        INITL
SETUP called by:
       SRCIRR
SHADOW called by:
         BDRF        TERMPR
SHNGEO called by:
       SCNRIO        SRCIRR
SICEBD called by:
       SEAICE
SKYNOI called by:
       EQUABS
SLPOS called by:
       EPHEMS        MOSART
SLR1BD called by:
       SLRCNT         SOLAR
SLR2BD called by:
        SOLAR
SLR3BD called by:
        SOLAR
SLR4BD called by:
        SOLAR
SLR5BD called by:
        SOLAR
SLRCNT called by:
       BRBNDR        PUTSLR
SLUNAR called by:
       BCKGND        PRCALC
SMPCAL called by:
       PRCALC
SNOWBD called by:
       SNOWEX
SNOWEX called by:
       HYDROM
SNOWSP called by:
       BNDPAR
SO2BD called by:
       ABSSO2
SOIL called by:
       DEMSXX
SOLAR called by:
       BCKGND        DBANDS        EMISSV        PRCALC        SLUNAR
SOLBND called by:
       BRBNDR
SOLRAD called by:
       PRCALC        RSHINE
SPCLYR called by:
       BRBNDR
SPHAIR called by:
       SPCLYR
SPHICE called by:
       SPCLYR
```

```
SPHWTR called by:
       SPCLYR
SPTRIG called by:
       DEFBCK        EPHEMS        GETSLR        SCNRIO        SHNGEO        SRCGEO
       SRCIRR
SRAT called by:
       SOLBND
SRCFLX called by:
       CALCUL
SRCGEO called by:
       CALCUL
SRCIRR called by:
       CALCUL
SRFLUX called by:
       HTBLNC
SRTLAY called by:
       INICPL        SOLBND
STARAD called by:
       BCKGND
STGEOM called by:
        INITL
STMLBD called by:
        EQABS         USRDEF
STRCN2 called by:
        ENDPT         EQUABS        TANGPT
SUB called by:
       CNSTNT
SUMFIL called by:
       CALCUL
SUPK called by:
       REFRAC
SWAT called by:
       SOLBND
TANGPT called by:
       RAYPTH
TERMPR called by:
       PRCALC        RSHINE
THCAIR called by:
       SPCLYR
THCICE called by:
       SPCLYR
THCSNW called by:
       SPCLYR
THCWTR called by:
       SPCLYR
TITLCR called by:
       MOSART
TMPCLD called by:
       CLDALT
TRANLW called by:
        OPATH
TRNSMT called by:
       PTHTAU
TURBUL called by:
       SCNRIO
UDIF called by:
          SWAT
UDLAY called by:
       INICPL        SOLBND
UFTPBD called by:
       ABSMOL
```

```
UPCASE called by:
       BINFIL        DFLT8        FILOPN        FLSTAT        GETASP        GETATM
       GETBCK       GETCLD        GETEXO        GETPOS        GETSLR         INITL
       MIEINP        MONTH        NCHAER        NCHATM        NCHAZE        NCHSEA
       RDFLTR       STGEOM        USRBCK        USRCLD        USRDEF
UPPRBD called by:
        EQABS       EXOATM        SETALT
USRBCK called by:
       GETBCK
USRCLD called by:
       GETCLD
USRDEF called by:
        INITL
VIRIAL called by:
       DENAIR
VIRLBD called by:
       VIRIAL
VISRH called by:
       EQUABS
VSA called by:
        INITL
WTRBD called by:
       INDEXW
XMCONV called by:
       USRDEF
XPNDAR called by:
       PRCALC
XTERP called by:
       ABCCL4       ABHNO4        ABN2O5        ABSCFC        ABSCLO         ABSO2
       AERSOL        AH2O2        BBARSL        BCKGND        BNDPAR        BRBNDR
       CHANGE       COUPLE         DEPOL         ENDPT         EQABS        EQUABS
       EVAPOR       EXGALS        EXOATM        FILTER          HAZE        HYDROM
       INDEXI       INDEXW        NXXPAU        PHYDRO        RAINSP        SCINTL
       SETALT       SLUNAR        SOLRAD        SPHICE        SPHWTR        STRCN2
       TANGPT       THCICE        THCWTR        USRDEF        VIRIAL        XMCONV
       XPNDAR
ZLAT called by:
       DBANDS
ZOD1BD called by:
       EMISSV
ZOD2BD called by:
       DBANDS       ZODICL
ZODICL called by:
       BCKGND
ZROHDR called by:
        INITL
ZROINT called by:
       PRCALC
```

7.1.3 MOSART Pre-Requisite Order List

```
       MOSART       TITLCR         FDATE        RDFLTR        PROMPT         INITL
       ZROHDR          VSA        USRDEF        XMCONV        STGEOM        SETFLG
       MIEINP       ISRAEL        GETSLR        GETPOS         MONTH        GETEXO
       GETCLD       USRCLD        GETBCK        USRBCK         PARSE        GETATM
       NCHSEA       NCHAZE        NCHATM        NCHAER        MRNDFL        LWCASE
       IGTVEC       GETVAR        GETASP        IGTINT         FILRT        FILOPN
       EXOTMP        DFLT8        GETVEC         DFLT2        IDAERO        DEFALT
       EXOATM       CIRRUS        BINFIL        RDLINE        LCTRIM        FLSTAT
       UPCASE       DISEND        CHKVER        CHKRST        BEAUFT        EQUABS
        VISRH       SKYNOI        SETALT        NXXPAU         HEYMS        CLDALT
       TMPCLD       CHANGE        DBINIT        CONFIG        CNSTNT           SUB
          MUL          DSUB          DMUL           DIV          DDIV          DADD
          ADD       CALCUL        SUMFIL        PUTSLR        PUTCLD        LENSTR
```

CHTIME	SRCIRR	SETUP	ASPECT	SRCGEO	SRCFLX
SCNRIO	TURBUL	SHNGEO	HOREQU	EQUECL	ECLGAL
DEFBCK	BCKCHK	CALEND	PUTHDR	PRTHDR	PRCALC
ZROINT	XPNDAR	SMPCAL	SCINTL	RSHINE	TERMPR
SOLRAD	PTHTAU	TRNSMT	BAND	BNTPTH	MLSCAT
RADTRY	RESOLV	DVINCR	PTHOSB	RADTRX	PLMSUB
COMFNC	KDISTR	INTEG	FILTER	DPLDT	DISPRN
COUPLE	INICPL	ESFIT	BCKGND	ZODICL	GETGLC
EMISSV	DBANDS	ZLAT	STARAD	SLUNAR	SOLAR
REFEST	GALRAD	EXGALS	DEMSXX	SOIL	SEAWTR
DIREMS	FRESNL	EHBSL0	POLY	BDRF	SHADOW
DERF	DIREFL	BNDPAR	SNOWSP	RAINSP	PHMLSC
PHFUNC	PHYDRO	CSPHFN	BMOD	RADFLD	O2CNT
H2OCNT	EVEN	AMMNIA	AH2O2	ABSSO2	ABSO3
ABSO2	ABSNO2	ABSN2O	ABSN2	ABSMOL	ABSH2O
ABSCLO	ABSCFC	ABN2O5	ABHNO4	ABCCL4	AMOLSC
DEPOL	BCKPRN	ATMPRN	SETBCK	MODBCK	INTR2D
PRALT	INDXBK	GBLBCK	RDSCN	IBKCNV	CITIES
RDGBL	SEAICE	OPNSCR	BRBNDR	SPCLYR	THCWTR
THCSNW	THCICE	THCAIR	SPHWTR	SPHICE	SPHAIR
DENWTR	DENAIR	VIRIAL	SOLBND	UDLAY	SWAT
UDIF	RBE	RAB	GAM	DDIF	SRTLAY
SRAT	CLDLYR	BETAU	BETA	BBO3	SLRCNT
SEATMP	PRETEM	OPATH	TRANLW	LAYLW	IOERR
GERROR	HTBLNC	SRFLUX	EVAPOR	FLUXLW	EPHEMS
SPTRIG	SLPOS	HORIZN	GEOM	RAYPTH	TANGPT
INIGEO	ENDPT	STRCN2	ISTAER	HYDROM	SNOWEX
RAINEX	CIREX	HAZE	HLOWT	EQABS	RELHUM
SATUR	REFRAC	SUPK	PFR	PARTIT	MDLATM
BNDMLG	AERSOL	MIEPHS	MIE	INDEXW	INDEXI
EMTREF	DNDR	GAMMLN	COAT	NCYCLE	MARINE
PROFAC	DESAER	PLANET	EPHTIM	EPHEML	BBARSL
XTERP	IBNSRC	AIRTMP	AECALC	PLANCK	

7.1.4 MOSART Common Block Cross-Reference List

Common Block DEVCNM used in:					
DBINIT	DEVCBD	FILRT	MOSART	RDGBL	RDSCN
SUMFIL					
Common Block DEVICE used in:					
ABSMOL	ATMPRN	BCKPRN	BRBNDR	CALCUL	DBINIT
DEFALT	DEVCBD	DFLT8	EQUABS	FLSTAT	GETASP
GETATM	GETBCK	GETCLD	GETPOS	GETSLR	INITL
MIEINP	MOSART	PRCALC	PUTCLD	PUTHDR	PUTSLR
RDFLTR	RDGBL	RDSCN	SUMFIL	USRBCK	USRCLD
Common Block FLAGS used in:					
ATMPRN	BCKCHK	BCKPRN	BINFIL	CALCUL	EPHEMS
EQABS	HAZE	INICPL	INITL	ISRAEL	MOSART
PRCALC	PUTSLR	RSHINE	SCNRIO	SETFLG	SRCIRR
SUMFIL	TERMPR				
Common Block HEADER used in:					
ATMPRN	BCKGND	BCKPRN	BNDPAR	BRBNDR	CALCUL
COUPLE	DEFALT	DEFBCK	ENDPT	EQABS	EQUABS
GETASP	GETATM	GETBCK	GETCLD	INICPL	INIGEO
INITL	KDISTR	MOSART	PRCALC	PRTHDR	PTHOSB
PUTCLD	PUTHDR	PUTSLR	RSHINE	SCNRIO	SETBCK
SRCFLX	SRCIRR	SUMFIL	TANGPT	USRDEF	ZROHDR
Common Block INITAL used in:					
BBARSL	BMOD	BNDPAR	BRBNDR	CALCUL	COUPLE
ENDPT	EPHEMS	EQUABS	GEOM	HYDROM	INICPL
INIGEO	INITL	MOSART	PLMSUB	PRCALC	PRETEM
PTHOSB	PUTHDR	RAYPTH	RSHINE	SCNRIO	SETALT
SHNGEO	SOLBND	SRCGEO	SRCIRR	TANGPT	

```
Common Block CRSECT used in:
       ABCCL4       ABHNO4       ABN2O5       ABSCLO       CROSBD
Common Block CFCBM used in:
       ABSCFC        CFCBD
Common Block CONSTN used in:
       ABSMOL       AIRTMP       AMOLSC       ASPECT       ATMPRN        BAND
       BCKGND       BCKPRN         BDRF         BETA        BETAU         BMOD
       BNDPAR       BRBNDR       CNSTNT         COAT       COMFNC       COUPLE
       CSPHFN       DBINIT       DESAER       DFLT2        DFLT8       DIREMS
         DNDR        DPLDT       ECLGAL       ENDPT       EPHEML       EPHEMS
        EQABS       EQUABS       EQUECL       ESFIT       EXGALS       EXOTMP
       FILTER       FRESNL       GALRAD        GEOM       GETSLR       HOREQU
       HORIZN       HTBLNC       INICPL      INIGEO        INITL       MARINE
          MIE       MIEPHS       MLSCAT      MODBCK       PHFUNC       PHMLSC
       PHYDRO       PLANCK       PLANET      PRCALC       PRETEM       PROFAC
       PTHOSB       PTHTAU       RADTRX      RADTRY       RAINEX       REFEST
       RSHINE        SATUR       SCINTL      SCNRIO       SETALT        SETUP
       SHADOW       SHNGEO       SKYNOI       SLPOS       SLUNAR       SNOWEX
       SOLBND       SPCLYR       SPTRIG      SRCGEO       SRCIRR       SRTLAY
       STARAD       STGEOM       STRCN2        SUPK       TERMPR        UDLAY
       USRDEF        XTERP         ZLAT      ZODICL
Common Block MOLECP used in:
       ABSMOL       BBARSL         BMOD      BNDPAR       DBINIT        DFLT8
       DVINCR       EMISSV        ENDPT       EQABS       EQUABS       KDISTR
       PLMSUB       PRCALC       PTHOSB      PTHTAU       PUTHDR       SCNRIO
       SUMFIL       TANGPT       USRDEF
Common Block UFTAPE used in:
       ABSMOL       UFTPBD
Common Block NO2XS used in:
       ABSNO2        NO2BD
Common Block HERZBG used in:
        ABSO2       O2UVBD
Common Block SHURUN used in:
        ABSO2       O2UVBD
Common Block O3CWB used in:
        ABSO3       O3CWBD
Common Block O3HHB used in:
        ABSO3       O3HHBD
Common Block SO2XS used in:
       ABSSO2        SO2BD
Common Block AEROSL used in:
       AERSOL       ARSLBD       BBARSL      BNDPAR       HYDROM       MARINE
       PHFUNC       PHYDRO       PRCALC      RSHINE
Common Block AERSCA used in:
       AERSOL       BBARSL       BNDPAR      PHFUNC
Common Block AERSLA used in:
       AERSOL       ARSABD       HYDROM      MARINE
Common Block AERSLX used in:
       AERSOL       ARSXBD       HYDROM      MARINE
Common Block AERUSR used in:
       AERSOL       PHFUNC
Common Block BSTAER used in:
       AERSOL       BKSTBD       PHFUNC
Common Block USERDF used in:
       ASPECT       DEFALT        EQABS      GETASP         HAZE       ISTAER
       SETALT       STRCN2       USRDEF
Common Block ATMDAT used in:
       ATMPRN       ATMSBD       BCKPRN      BRBNDR       CALCUL        DFLT2
        EQABS       EQUABS        INITL      PRCALC       SCNRIO       SETALT
       SETBCK       SHNGEO       SRCGEO      SRCIRR       USRDEF
Common Block BACKGD used in:
       ATMPRN       BCKGND       BKGDBD      BRBNDR       COUPLE       GETBCK
        INITL       SETBCK       SPCLYR      USRBCK
```

```
Common Block CHRCNM used in:
       ATMPRN          BRBNDR          CHRCBD          EQUABS          PUTCLD          SUMFIL
       USRBCK
Common Block INTSTO used in:
       ATMPRN          DISPRN           INTEG          PRCALC          RSHINE          ZROINT
Common Block OUTPUT used in:
       ATMPRN          BCKPRN          BRBNDR          EQUABS           INITL
Common Block SCENES used in:
       ATMPRN          SCENBD          SETBCK          TERMPR          USRBCK
Common Block BCKDAT used in:
       BCKPRN          DISPRN          EQUABS           INTEG          KDISTR          PRCALC
       PUTHDR          SCNRIO          ZROINT
Common Block RSTART used in:
       BINFIL          CALCUL
Common Block MOLCON used in:
         BMOD          BNDPAR          BRBNDR           ENDPT           EQABS          EQUABS
       MOLPBD          PLMSUB          PRCALC          PRETEM          PUTHDR          SCNRIO
       TANGPT
Common Block MOLDAT used in:
         BMOD          DENAIR           EQABS          MOLPBD          PARTIT          XMCONV
Common Block PRBNDA used in:
         BMOD          BNDPAR          INICPL          KDISTR          PLMSUB          PTHOSB
       PTHTAU
Common Block PRBNDB used in:
         BMOD          BNDPAR          INICPL          KDISTR          PLMSUB          PTHTAU
Common Block AERSCC used in:
       BNDPAR          HYDROM
Common Block ARSLSC used in:
       BNDPAR          INICPL          MLSCAT          PHFUNC          PRCALC          PTHOSB
       RSHINE
Common Block CGWTS used in:
       BNDPAR          PTHTAU
Common Block CLDUSR used in:
       BNDPAR          HYDROM          PHYDRO          USRCLD
Common Block ANTECD used in:
       BRBNDR          DEFALT           INITL
Common Block BRBNDT used in:
       BRBNDR          CALCUL          SRCFLX
Common Block LYRSTO used in:
       CALCUL          COUPLE          INICPL          MLSCAT          PRCALC          PTHOSB
       RSHINE
Common Block PATH1 used in:
       CALCUL          PLMSUB          PRCALC          PTHOSB          SCNRIO
Common Block PATH1A used in:
       CALCUL          PLMSUB          PRCALC          SCNRIO
Common Block PATH4 used in:
       CALCUL          COUPLE          PRCALC          RSHINE          SCNRIO          SRCIRR
Common Block PATH5A used in:
       CALCUL          DEFBCK          PRCALC          SCNRIO
Common Block PATH5B used in:
       CALCUL          PRCALC          SCNRIO
Common Block PATH5C used in:
       CALCUL          DEFBCK          PRCALC          SCNRIO
Common Block PATH5D used in:
       CALCUL          PRCALC          SCNRIO
Common Block PATH6 used in:
       CALCUL          PRCALC
Common Block PATH8 used in:
       CALCUL          PRCALC
Common Block CLDPAR used in:
       BRBNBD          CLDLYR          FLUXLW
Common Block MIECOT used in:
         COAT             MIE          MIEPHS
Common Block MSPARM used in:
       COUPLE          INICPL          PRCALC
```

```
Common Block ZODBND used in:
       DBANDS        ZOD2BD
Common Block CDRYDS used in:
       DEMSXX        EMISBD
Common Block WETNES used in:
       DEMSXX        EMISBD
Common Block DESDAT used in:
       DESAER        DSRTBD
Common Block MATERL used in:
         DNDR        MIEINP        MIEPHS
Common Block SILEMS used in:
       EMISSV        ZOD1BD
Common Block CLDRN used in:
       CLDRBD         ENDPT        EQUABS        GETCLD        HYDROM        PUTCLD
       RAINSP        TANGPT        USRCLD
Common Block PLMDAT used in:
        ENDPT        EQUABS        PLMSUB        TANGPT
Common Block VSADTA used in:
        ENDPT         EQABS        EQUABS         INITL        TANGPT           VSA
Common Block PERLUN used in:
       EPHEML        LUNPBD
Common Block EXTMOL used in:
        EQABS        EXMLBD        USRDEF
Common Block STDMOL used in:
        EQABS        STMLBD        USRDEF
Common Block UPRATM used in:
        EQABS        EXOATM        SETALT        UPPRBD
Common Block LAGUER used in:
        ESFIT        LAGRBD
Common Block FLTRDT used in:
       FILTER        RDFLTR
Common Block MACHIN used in:
       DEVCBD        FLSTAT
Common Block CLIMAT used in:
       FLUXLW         OPATH        PRETEM          SRAT
Common Block OMATLW used in:
       FLUXLW         OPATH        SOLBND        TRANLW
Common Block GAUSSL used in:
       GETGLC        GLCFBD
Common Block CONTNS used in:
        H2OBD        H2OCNT
Common Block HZDATA used in:
          HAZE       HAZEBD
Common Block ECOCNV used in:
       ECOSBD        IBKCNV
Common Block ICEREF used in:
        ICEBD        INDEXI
Common Block INDXWR used in:
       INDEXW         WTRBD
Common Block INPTDT used in:
        INITL        INPTBD
Common Block KDISDT used in:
       KDISTR        PRCALC
Common Block NAVMAR used in:
       MARINE        MARNBD
Common Block O2C used in:
        O2CBD         O2CNT
Common Block PHFFOG used in:
       PHFGBD        PHFUNC
Common Block PHFMAR used in:
       PHFUNC        PHMABD
Common Block PHFOCE used in:
       PHFUNC        PHOCBD
Common Block PHFRUR used in:
       PHFUNC        PHRUBD
```

```
Common Block PHFSTR used in:
       PHFUNC        PHSTBD
Common Block PHFTRP used in:
       PHFUNC        PHTRBD
Common Block PHFURB used in:
       PHFUNC        PHURBD
Common Block CRASYM used in:
       CIRRBD        PHYDRO
Common Block PHHYDR used in:
       PHHYBD        PHYDRO
Common Block CURGDA used in:
       PRCALC        PTHTAU        RSHINE
Common Block CURGDB used in:
       PRCALC        PTHTAU        RSHINE
Common Block CURGDC used in:
       PRCALC        PTHOSB        PTHTAU        RSHINE
Common Block OPTDEP used in:
       PRCALC        PTHTAU        RSHINE
Common Block TRANSP used in:
       PRCALC        TRNSMT
Common Block RAINTP used in:
       RAINBD        RAINEX        RAINSP
Common Block RAINWL used in:
       RAINBD        RAINSP        SNOWSP
Common Block INFLTR used in:
       INFLBD        RDFLTR
Common Block MMWREF used in:
       REFRAC        REFRBD
Common Block PATH2 used in:
       RSHINE        SRCIRR
Common Block PATH2A used in:
       RSHINE        SRCIRR
Common Block PATH2B used in:
       RSHINE        SRCIRR
Common Block PATH2C used in:
       RSHINE        SRCIRR
Common Block PATH2D used in:
       RSHINE        SRCIRR
Common Block SICEDT used in:
       SEAICE        SICEBD
Common Block TMPOCN used in:
       OCNTBD        SEATMP
Common Block SOLIR1 used in:
       SLR1BD        SLRCNT         SOLAR
Common Block SNWDAT used in:
       SNOWBD        SNOWEX
Common Block SOLIR2 used in:
       SLR2BD         SOLAR
Common Block SOLIR3 used in:
       SLR3BD         SOLAR
Common Block SOLIR4 used in:
       SLR4BD         SOLAR
Common Block SOLIR5 used in:
       SLR5BD         SOLAR
Common Block SWPARM used in:
       BRBNBD        SOLBND
Common Block USERNM used in:
       SUMFIL        USRDEF
Common Block FLXTAB used in:
       BRBNBD        TRANLW
Common Block VIRDAT used in:
       VIRIAL        VIRLBD
Common Block ZPLANE used in:
       ZOD2BD        ZODICL
```

```
Common Block ECOSYS used in:
       ECOSBD
Common Block INPNDX used in:
       INPTBD
```

7.2 ASCBIN

7.2.1 ASCBIN Subprogram References

```
ASCBIN calls:
       CNSTNT       CONFIG       CONVAB        FILRT        IOERR        PROMPT
       SETFIL       TABLEA       TABLEB       TABLEH       TABLET       UPCASE
CNSTNT calls:
          ADD         DADD         DDIV          DIV         DMUL         DSUB
          MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
CONVAB calls:
        IOERR       SETFIL
IOERR calls:
       GERROR
GERROR calls: none
SETFIL calls:
        IOERR
FILRT calls:
       LCTRIM
LCTRIM calls: none
PROMPT calls: none
TABLEA calls:
       FILTER       GETHDR        IOERR       PROMPT       RDFLTR       SLITFN
       UPCASE
FILTER calls:
        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
GETHDR calls:
        IOERR
RDFLTR calls:
       GETVAR        IOERR       LCTRIM       LENSTR       LWCASE        PARSE
       RDLINE       UPCASE
GETVAR calls:
        IOERR
LENSTR calls: none
LWCASE calls: none
PARSE calls:
       LCTRIM       LENSTR
RDLINE calls:
        IOERR       LCTRIM       LENSTR
UPCASE calls: none
SLITFN calls: none
TABLEB calls:
       FILTER       GETHDR        IOERR       PROMPT       RDFLTR       SLITFN
       UPCASE
TABLEH calls:
       GETHDR        IOERR       PROMPT
```

```
TABLET calls:
       GETHDR          IOERR          PROMPT         SLITFN
```

7.2.2 ASCBIN Cross-Reference List

```
ADD called by:
       CNSTNT
ASCBIN not called
CNSTNT called by:
       ASCBIN
CONFIG called by:
       ASCBIN
CONVAB called by:
       ASCBIN
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DEVCBD called by:
       ASCBIN          FILRT          RDFLTR
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
FILRT called by:
       ASCBIN
FILTER called by:
       TABLEA          TABLEB         TABLET
GERROR called by:
        IOERR
GETHDR called by:
       TABLEA          TABLEB         TABLEH         TABLET
GETVAR called by:
       RDFLTR
IBNSRC called by:
        XTERP
INFLBD called by:
       RDFLTR
IOERR called by:
       ASCBIN          CONVAB         GETHDR         GETVAR         RDFLTR         RDLINE
       SETFIL          TABLEA         TABLEB         TABLEH         TABLET
LCTRIM called by:
        FILRT           PARSE          RDFLTR         RDLINE
LENSTR called by:
        PARSE          RDFLTR         RDLINE
LWCASE called by:
       RDFLTR
MOLNBD called by:
       TABLET
MUL called by:
       CNSTNT
PARSE called by:
       RDFLTR
PROMPT called by:
       ASCBIN          TABLEA         TABLEB         TABLEH         TABLET
RDFLTR called by:
       TABLEA          TABLEB
RDLINE called by:
       RDFLTR
SETFIL called by:
       ASCBIN          CONVAB
```

```
SLITFN called by:
       TABLEA       TABLEB       TABLET
SUB called by:
       CNSTNT
TABLEA called by:
       ASCBIN
TABLEB called by:
       ASCBIN
TABLEH called by:
       ASCBIN
TABLET called by:
       ASCBIN
UPCASE called by:
       ASCBIN       RDFLTR       TABLEA       TABLEB       TABLET
XTERP called by:
       FILTER
```

7.2.3 ASCBIN Pre-Requisite Order List

```
       ASCBIN       TABLET       TABLEH       TABLEB       TABLEA       SLITFN
       RDFLTR       UPCASE       RDLINE        PARSE       LENSTR       LWCASE
       GETVAR       PROMPT       GETHDR       FILTER        XTERP       IBNSRC
        FILRT       LCTRIM       CONVAB       SETFIL        IOERR       GERROR
       CONFIG       CNSTNT          SUB          MUL         DSUB         DMUL
          DIV         DDIV         DADD          ADD
```

7.2.4 ASCBIN Common Block Cross-Reference List

```
Common Block DEVCNM used in:
       ASCBIN       DEVCBD        FILRT
Common Block DEVICE used in:
       ASCBIN       DEVCBD       RDFLTR
Common Block CONSTN used in:
       CNSTNT       FILTER        XTERP
Common Block FLTRDT used in:
       FILTER       RDFLTR
Common Block HEADER used in:
       GETHDR       TABLEA       TABLEB       TABLEH       TABLET
Common Block INFLTR used in:
       INFLBD       RDFLTR
Common Block MOLNMX used in:
       MOLNBD       TABLET
Common Block MACHIN used in:
       DEVCBD
```

7.3 BBTEMP

7.3.1 BBTEMP Subprogram References

```
BBTEMP calls:
       CNSTNT       CONFIG        FILRT       FILTER       GETHDR       INVPLK
        IOERR       PROMPT       RDFLTR       SETFLG       SUMFIL
CNSTNT calls:
          ADD         DADD         DDIV          DIV         DMUL         DSUB
          MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
```

```
SUB calls: none
CONFIG calls: none
FILRT calls:
       LCTRIM
LCTRIM calls: none
FILTER calls:
        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
GETHDR calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
INVPLK calls: none
PROMPT calls: none
RDFLTR calls:
       GETVAR          IOERR          LCTRIM         LENSTR         LWCASE         PARSE
       RDLINE         UPCASE
GETVAR calls:
        IOERR
LENSTR calls: none
LWCASE calls: none
PARSE calls:
       LCTRIM         LENSTR
RDLINE calls:
        IOERR         LCTRIM         LENSTR
UPCASE calls: none
SETFLG calls: none
SUMFIL calls:
       CHTIME          IOERR         LENSTR         PUTCLD         PUTSLR
CHTIME calls: none
PUTCLD calls:
        IOERR
PUTSLR calls:
        IOERR         SLRCNT
SLRCNT calls: none
```

7.3.2 BBTEMP Cross-Reference List

```
ADD called by:
       CNSTNT
BBTEMP not called
CHRCBD called by:
       PUTCLD         SUMFIL
CHTIME called by:
       SUMFIL
CLDRBD called by:
       PUTCLD
CNSTNT called by:
       BBTEMP
CONFIG called by:
       BBTEMP
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DEVCBD called by:
       BBTEMP          FILRT         PUTCLD         PUTSLR         RDFLTR         SUMFIL
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
```

```
DSUB called by:
        CNSTNT
FILRT called by:
        BBTEMP
FILTER called by:
        BBTEMP
GERROR called by:
         IOERR
GETHDR called by:
        BBTEMP
GETVAR called by:
        RDFLTR
IBNSRC called by:
         XTERP
INFLBD called by:
        RDFLTR
INVPLK called by:
        BBTEMP
IOERR called by:
        BBTEMP       GETHDR       GETVAR       PUTCLD       PUTSLR       RDFLTR
        RDLINE       SUMFIL
LCTRIM called by:
         FILRT        PARSE       RDFLTR       RDLINE
LENSTR called by:
         PARSE       RDFLTR       RDLINE       SUMFIL
LWCASE called by:
        RDFLTR
MUL called by:
        CNSTNT
PARSE called by:
        RDFLTR
PROMPT called by:
        BBTEMP
PUTCLD called by:
        SUMFIL
PUTSLR called by:
        SUMFIL
RDFLTR called by:
        BBTEMP
RDLINE called by:
        RDFLTR
SETFLG called by:
        BBTEMP
SLR1BD called by:
        SLRCNT
SLRCNT called by:
        PUTSLR
SUB called by:
        CNSTNT
SUMFIL called by:
        BBTEMP
UPCASE called by:
        RDFLTR
XTERP called by:
        FILTER
```

7.3.3 BBTEMP Pre-Requisite Order List

```
        BBTEMP       SUMFIL       PUTSLR       SLRCNT       PUTCLD       CHTIME
        SETFLG       RDFLTR       UPCASE       RDLINE        PARSE       LENSTR
        LWCASE       GETVAR       PROMPT       INVPLK       GETHDR        IOERR
        GERROR       FILTER        XTERP       IBNSRC        FILRT       LCTRIM
        CONFIG       CNSTNT          SUB          MUL         DSUB         DMUL
           DIV         DDIV         DADD          ADD
```

7.3.4 BBTEMP Common Block Cross-Reference List

```
Common Block CONSTN used in:
       BBTEMP        CNSTNT        FILTER        INVPLK        XTERP
Common Block DEVICE used in:
       BBTEMP        DEVCBD        PUTCLD        PUTSLR        RDFLTR        SUMFIL
Common Block FLAGS used in:
       BBTEMP        PUTSLR        SETFLG        SUMFIL
Common Block HEADER used in:
       BBTEMP        GETHDR        PUTCLD        PUTSLR        SUMFIL
Common Block MOLECP used in:
       BBTEMP        SUMFIL
Common Block USERNM used in:
       BBTEMP        SUMFIL
Common Block FLTRDT used in:
       FILTER        RDFLTR
Common Block CHRCNM used in:
       CHRCBD        PUTCLD        SUMFIL
Common Block CLDRN used in:
       CLDRBD        PUTCLD
Common Block INFLTR used in:
       INFLBD        RDFLTR
Common Block SOLIR1 used in:
       SLR1BD        SLRCNT
Common Block DEVCNM used in:
       DEVCBD         FILRT        SUMFIL
Common Block MACHIN used in:
       DEVCBD
```

7.4 CRFILE

7.4.1 CRFILE Subprogram References

```
CRFILE calls:
       CONFIG        CRBKGD        CRFLTR        CRINPT        CRUAER        CRUATM
       CRUCLD         FILRT         IOERR         MENU        PROMPT        RDMDTN
CONFIG calls: none
CRBKGD calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
CRFLTR calls:
        IOERR        LCTRIM        LENSTR        PROMPT        UPCASE
LCTRIM calls: none
LENSTR calls: none
PROMPT calls: none
UPCASE calls: none
CRINPT calls:
       CALEND        CHTIME        CRUATM        GETVAR        IGTINT         IOERR
       LCTRIM        LWCASE          MENU         MONTH        PROMPT        UPCASE
CALEND calls: none
CHTIME calls: none
CRUATM calls:
       CALEND        CHTIME        GETVAR        IGTINT         IOERR        LCTRIM
       LWCASE          MSAG        PROMPT        UPCASE
GETVAR calls:
        IOERR
IGTINT calls:
        IOERR
LWCASE calls: none
```

```
MSAG calls:
        CALEND        EPHTIM          MDRI
EPHTIM calls: none
MDRI calls:
        AFTERP        DNCALC           DNO         DREAD          GTD6        INTERP
        OHCALC        POZONE        SINTRP           SUN          TDEP           VP
AFTERP calls: none
DNCALC calls:
        SOLZEN
SOLZEN calls:
        LATPHI        SUBSOL
LATPHI calls: none
SUBSOL calls: none
DNO calls:
        SINTRP
SINTRP calls: none
DREAD calls: none
GTD6 calls:
         DENSM         GLATF        GLOB6S          GTS6          VTST
DENSM calls:
        SPLINE        SPLINI        SPLINT
SPLINE calls: none
SPLINI calls: none
SPLINT calls: none
GLATF calls: none
GLOB6S calls: none
GTS6 calls:
          CCOR         DENSU          DNET        GLOB6S        GLOBE6          VTST
CCOR calls: none
DENSU calls:
        SPLINE        SPLINI        SPLINT
DNET calls: none
GLOBE6 calls:
        TSELEC
TSELEC calls: none
VTST calls: none
INTERP calls: none
OHCALC calls: none
POZONE calls: none
SUN calls:
        DECEQT
DECEQT calls: none
TDEP calls: none
VP calls: none
MENU calls:
         IOERR        PROMPT
MONTH calls:
        LCTRIM        UPCASE
CRUAER calls:
         IOERR
CRUCLD calls:
         IOERR
FILRT calls:
        LCTRIM
RDMDTN calls:
        CNVJTK         IOERR        PROMPT
CNVJTK calls:
         IOERR
```

7.4.2 CRFILE Cross-Reference List

```
AFTERP called by:
          MDRI
```

```
CALEND called by:
       CRINPT          CRUATM          MSAG
CCOR called by:
         GTS6
CHRCBD called by:
         MENU
CHTIME called by:
       CRINPT          CRUATM
CNVJTK called by:
       RDMDTN
CONFIG called by:
       CRFILE
CRBKGD called by:
       CRFILE
CRFILE not called
CRFLTR called by:
       CRFILE
CRINPT called by:
       CRFILE
CRUAER called by:
       CRFILE
CRUATM called by:
       CRFILE          CRINPT
CRUCLD called by:
       CRFILE
DECEQT called by:
         SUN
DENSM called by:
         GTD6
DENSU called by:
         GTS6
DEVCBD called by:
       CRBKGD          CRFILE          CRFLTR          CRINPT          CRUAER          CRUATM
       CRUCLD          FILRT           MDRI
DNCALC called by:
         MDRI
DNET called by:
         GTS6
DNO called by:
         MDRI
DREAD called by:
         MDRI
EPHTIM called by:
         MSAG
FILRT called by:
       CRFILE
GERROR called by:
         IOERR
GETVAR called by:
       CRINPT          CRUATM
GLATF called by:
         GTD6
GLOB6S called by:
         GTD6            GTS6
GLOBE6 called by:
         GTS6
GTD6 called by:
         MDRI
GTD6BK called by:
         GTD6
GTS6 called by:
         GTD6
IGTINT called by:
       CRINPT          CRUATM
```

```
INARBD called by:
       CRUAER
INBKBD called by:
       CRBKGD
INCLBD called by:
       CRUCLD
INFLBD called by:
       CRFLTR
INPTBD called by:
       CRINPT        CRUATM        RDMDTN
INTERP called by:
         MDRI
IOERR called by:
       CNVJTK        CRBKGD        CRFILE        CRFLTR        CRINPT        CRUAER
       CRUATM        CRUCLD        GETVAR        IGTINT         MENU         RDMDTN
LATPHI called by:
       SOLZEN
LCTRIM called by:
       CRFLTR        CRINPT        CRUATM         FILRT         MONTH
LENSTR called by:
       CRFLTR
LWCASE called by:
       CRINPT        CRUATM
MDRI called by:
         MSAG
MENU called by:
       CRFILE        CRINPT
MONTH called by:
       CRINPT
MSAG called by:
       CRUATM
NRLBD called by:
        DREAD          MDRI
OHCALC called by:
         MDRI
POZONE called by:
         MDRI
PROMPT called by:
       CRFILE        CRFLTR        CRINPT        CRUATM         MENU         RDMDTN
RDMDTN called by:
       CRFILE
SINTRP called by:
          DNO          MDRI
SOLZEN called by:
       DNCALC
SPLINE called by:
        DENSM         DENSU
SPLINI called by:
        DENSM         DENSU
SPLINT called by:
        DENSM         DENSU
SUBSOL called by:
       SOLZEN
SUN called by:
         MDRI
TDEP called by:
         MDRI
TSELEC called by:
       GLOBE6
UPCASE called by:
       CRFLTR        CRINPT        CRUATM        MONTH
VP called by:
         MDRI
VTST called by:
         GTD6          GTS6
```

7.4.3 CRFILE Pre-Requisite Order List

CRFILE	RDMDTN	CNVJTK	FILRT	CRUCLD	CRUAER
CRINPT	MONTH	MENU	CRUATM	MSAG	MDRI
VP	TDEP	SUN	DECEQT	POZONE	OHCALC
INTERP	GTD6	GTS6	VTST	GLOBE6	TSELEC
GLOB6S	DNET	DENSU	CCOR	GLATF	DENSM
SPLINT	SPLINI	SPLINE	DREAD	DNO	SINTRP
DNCALC	SOLZEN	SUBSOL	LATPHI	AFTERP	EPHTIM
CALEND	LWCASE	IGTINT	GETVAR	CHTIME	CRFLTR
UPCASE	PROMPT	LENSTR	LCTRIM	CRBKGD	IOERR
GERROR	CONFIG				

7.4.4 CRFILE Common Block Cross-Reference List

Common Block DEVICE used in:					
CRFILE	DEVCBD				
Common Block INBKGD used in:					
CRBKGD	INBKBD				
Common Block MACHIN used in:					
CRBKGD	CRFLTR	CRINPT	CRUAER	CRUATM	CRUCLD
DEVCBD					
Common Block INFLTR used in:					
CRFLTR	INFLBD				
Common Block HEADER used in:					
CRINPT	CRUATM				
Common Block INPNDX used in:					
CRINPT	CRUATM	INPTBD	RDMDTN		
Common Block INPTDT used in:					
CRINPT	CRUATM	INPTBD	RDMDTN		
Common Block INUAER used in:					
CRUAER	INARBD				
Common Block INUCLD used in:					
CRUCLD	INCLBD				
Common Block PARMB used in:					
DENSM	DENSU	GTD6			
Common Block DBASE used in:					
DREAD	INTERP				
Common Block NRLDEV used in:					
DREAD	NRLBD				
Common Block LPOLY used in:					
GLOB6S	GLOBE6				
Common Block CSW used in:					
GLOB6S	GLOBE6	GTD6	GTS6	TSELEC	VTST
Common Block GTS3C used in:					
GTD6	GTS6				
Common Block MESO6 used in:					
GTD6	GTS6				
Common Block LOWER6 used in:					
GTD6	GTD6BK	GTS6			
Common Block PARM6 used in:					
GTD6	GTD6BK	GTS6			
Common Block MAVG6 used in:					
GTD6	GTD6BK				
Common Block DMIX used in:					
GTD6	GTS6				
Common Block METSEL used in:					
GTD6	GTD6BK	GTS6			
Common Block DEVCNM used in:					
DEVCBD	FILRT	MDRI			
Common Block NRLFIL used in:					
MDRI	NRLBD				

```
Common Block SPECIE used in:
        MDRI          NRLBD
Common Block CHRCNM used in:
       CHRCBD          MENU
```

7.5 FACET

7.5.1 FACET Subprogram References

```
FACET calls:
       CNSTNT        CONFIG        FILTER        GETHDR        GETVAR        GETVEC
        IOERR        LWCASE         PARSE        PROMPT        RDFLTR        RDLINE
       SETFLG        SUMFIL        SURFAC        UPCASE         XTERP
CNSTNT calls:
          ADD          DADD          DDIV           DIV          DMUL          DSUB
          MUL           SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
FILTER calls:
        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
GETHDR calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
GETVAR calls:
        IOERR
GETVEC calls:
        IOERR        LCTRIM        LENSTR
LCTRIM calls: none
LENSTR calls: none
LWCASE calls: none
PARSE calls:
       LCTRIM        LENSTR
PROMPT calls: none
RDFLTR calls:
       GETVAR         IOERR        LCTRIM        LENSTR        LWCASE         PARSE
       RDLINE        UPCASE
RDLINE calls:
        IOERR        LCTRIM        LENSTR
UPCASE calls: none
SETFLG calls: none
SUMFIL calls:
       CHTIME         IOERR        LENSTR        PUTCLD        PUTSLR
CHTIME calls: none
PUTCLD calls:
        IOERR
PUTSLR calls:
        IOERR        SLRCNT
SLRCNT calls: none
SURFAC calls:
         BDRF        DIREMS        FRESNL        PLANCK        PROFAC        REFEST
        ROUGH        SHADOW         XTERP
```

```
BDRF calls:
       DIREFL        SHADOW
DIREFL calls: none
SHADOW calls:
         DERF
DERF calls: none
DIREMS calls:
       EHBSL0        FRESNL        PLANCK
EHBSL0 calls:
         POLY
POLY calls: none
FRESNL calls: none
PLANCK calls: none
PROFAC calls:
       IBNSRC
REFEST calls: none
ROUGH calls:
       EHBSL0
```

7.5.2 FACET Cross-Reference List

```
ADD called by:
       CNSTNT
BDRF called by:
       SURFAC
CHRCBD called by:
       PUTCLD        SUMFIL
CHTIME called by:
       SUMFIL
CLDRBD called by:
       PUTCLD
CNSTNT called by:
        FACET
CONFIG called by:
        FACET
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DERF called by:
       SHADOW
DEVCBD called by:
        FACET        PUTCLD        PUTSLR        RDFLTR        SUMFIL
DIREFL called by:
         BDRF
DIREMS called by:
       SURFAC
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
EHBSL0 called by:
       DIREMS         ROUGH
FACET not called
FILTER called by:
        FACET
FRESNL called by:
       DIREMS        SURFAC
GERROR called by:
        IOERR
GETHDR called by:
        FACET
```

```
GETVAR called by:
        FACET       RDFLTR
GETVEC called by:
        FACET
IBNSRC called by:
       PROFAC        XTERP
INFLBD called by:
        FACET       RDFLTR
IOERR called by:
        FACET       GETHDR      GETVAR      GETVEC      PUTCLD      PUTSLR
       RDFLTR       RDLINE      SUMFIL
LCTRIM called by:
       GETVEC        PARSE      RDFLTR      RDLINE
LENSTR called by:
       GETVEC        PARSE      RDFLTR      RDLINE      SUMFIL
LWCASE called by:
        FACET       RDFLTR
MUL called by:
       CNSTNT
PARSE called by:
        FACET       RDFLTR
PLANCK called by:
       DIREMS       SURFAC
POLY called by:
       EHBSL0
PROFAC called by:
       SURFAC
PROMPT called by:
        FACET
PUTCLD called by:
       SUMFIL
PUTSLR called by:
       SUMFIL
RDFLTR called by:
        FACET
RDLINE called by:
        FACET       RDFLTR
REFEST called by:
       SURFAC
ROUGH called by:
       SURFAC
SETFLG called by:
        FACET
SHADOW called by:
         BDRF        FACET       SURFAC
SLR1BD called by:
       SLRCNT
SLRCNT called by:
       PUTSLR
SUB called by:
       CNSTNT
SUMFIL called by:
        FACET
SURFAC called by:
        FACET
UPCASE called by:
        FACET       RDFLTR
XTERP called by:
        FACET       FILTER      SURFAC
```

7.5.3 FACET Pre-Requisite Order List

```
        FACET       SURFAC        ROUGH       REFEST       PROFAC       DIREMS
       PLANCK       FRESNL       EHBSL0         POLY         BDRF      SHADOW
```

```
   DERF       DIREFL      SUMFIL      PUTSLR      SLRCNT      PUTCLD
 CHTIME       SETFLG      RDFLTR      UPCASE      RDLINE       PARSE
 LWCASE       GETVAR      PROMPT      GETVEC      LENSTR      LCTRIM
 GETHDR        IOERR      GERROR      FILTER       XTERP      IBNSRC
 CONFIG       CNSTNT         SUB         MUL        DSUB        DMUL
    DIV         DDIV        DADD         ADD
```

7.5.4 FACET Common Block Cross-Reference List

```
Common Block CONSTN used in:
     BDRF        CNSTNT      DIREMS       FACET      FILTER      FRESNL
   PLANCK       PROFAC      REFEST       ROUGH      SHADOW      SURFAC
    XTERP
Common Block DEVICE used in:
   DEVCBD        FACET      PUTCLD      PUTSLR      RDFLTR      SUMFIL
Common Block HEADER used in:
    FACET       GETHDR      PUTCLD      PUTSLR      SUMFIL
Common Block MATRLD used in:
    FACET       SURFAC
Common Block MOLECP used in:
    FACET       SUMFIL
Common Block USERNM used in:
    FACET       SUMFIL
Common Block FLTRDT used in:
   FILTER       RDFLTR
Common Block CHRCNM used in:
   CHRCBD       PUTCLD      SUMFIL
Common Block CLDRN used in:
   CLDRBD       PUTCLD
Common Block FLAGS used in:
   PUTSLR       SETFLG      SUMFIL
Common Block INFLTR used in:
   INFLBD       RDFLTR
Common Block SOLIR1 used in:
   SLR1BD       SLRCNT
Common Block DEVCNM used in:
   DEVCBD       SUMFIL
Common Block MACHIN used in:
   DEVCBD
```

7.6 FPTEST

7.6.1 FPTEST Subprogram References

```
FPTEST calls:
    CKSTAT       CNSTNT      CONFIG      FLCOL1       IOERR      LRECHK
    PROMPT       TITLCR
CKSTAT calls:
     ZSTAT
ZSTAT calls: none
CNSTNT calls:
       ADD         DADD        DDIV         DIV        DMUL        DSUB
       MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
```

```
FLCOL1 calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
LRECHK calls:
        IOERR
PROMPT calls: none
TITLCR calls:
        FDATE
FDATE calls: none
```

7.6.2 FPTEST Cross-Reference List

```
ADD called by:
       CNSTNT
CKSTAT called by:
       FPTEST
CNSTNT called by:
       FPTEST
CONFIG called by:
       FPTEST
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DEVCBD called by:
       FPTEST
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
FDATE called by:
       TITLCR
FLCOL1 called by:
       FPTEST
FPTEST not called
GERROR called by:
        IOERR
IOERR called by:
       FLCOL1       FPTEST       LRECHK
LRECHK called by:
       FPTEST
MUL called by:
       CNSTNT
PROMPT called by:
       FPTEST
SUB called by:
       CNSTNT
TITLCR called by:
       FPTEST
ZSTAT called by:
       CKSTAT
```

7.6.3 FPTEST Pre-Requisite Order List

```
       FPTEST       TITLCR       FDATE       PROMPT       LRECHK       FLCOL1
        IOERR       GERROR      CONFIG      CNSTNT          SUB          MUL
         DSUB         DMUL         DIV        DDIV         DADD          ADD
       CKSTAT        ZSTAT
```

7.6.4 FPTEST Common Block Cross-Reference List

```
Common Block CONSTN used in:
       CNSTNT       FPTEST
Common Block DEVICE used in:
       DEVCBD       FPTEST
Common Block MACHIN used in:
       DEVCBD       FPTEST
Common Block DEVCNM used in:
       DEVCBD
```

7.7 INSTDB

7.7.1 INSTDB Subprogram References

```
INSTDB calls:
       CONFIG        IOERR       LCTRIM       PROMPT       RDSCN        UPCASE
CONFIG calls: none
IOERR calls:
       GERROR
GERROR calls: none
LCTRIM calls: none
PROMPT calls: none
RDSCN calls:
       CITIES       IBKCNV        IOERR
CITIES calls: none
IBKCNV calls: none
UPCASE calls: none
```

7.7.2 INSTDB Cross-Reference List

```
CITIES called by:
        RDSCN
CONFIG called by:
       INSTDB
DEVCBD called by:
       INSTDB        RDSCN
ECOSBD called by:
       IBKCNV
GERROR called by:
        IOERR
IBKCNV called by:
        RDSCN
INSTDB not called
IOERR called by:
       INSTDB        RDSCN
LCTRIM called by:
       INSTDB
MOLNBD called by:
       INSTDB
PROMPT called by:
       INSTDB
RDSCN called by:
       INSTDB
UPCASE called by:
       INSTDB
```

7.7.3 INSTDB Pre-Requisite Order List

```
       INSTDB       UPCASE        RDSCN        IOERR       GERROR       IBKCNV
       CITIES       PROMPT       LCTRIM       CONFIG
```

7.7.4 INSTDB Common Block Cross-Reference List

```
Common Block DEVCNM used in:
       DEVCBD        INSTDB        RDSCN
Common Block DEVICE used in:
       DEVCBD        INSTDB        RDSCN
Common Block MOLNMX used in:
       INSTDB        MOLNBD
Common Block ECOCNV used in:
       ECOSBD        IBKCNV
Common Block ECOSYS used in:
       ECOSBD
Common Block MACHIN used in:
       DEVCBD
```

7.8 MRFLTR

7.8.1 MRFLTR Subprogram References

```
MRFLTR calls:
       ATMOUT        CNSTNT        CONFIG        DBINIT        GETHDR        INITL
        IOERR        PROMPT        RDFLTR        SETFLG        SUMFIL
ATMOUT calls:
       ATMINT        ATMPRN        BCKINT        BCKPRN        GETHDR        IOERR
       ZROINT
ATMINT calls:
       FILTER         IOERR
FILTER calls:
        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
IOERR calls:
       GERROR
GERROR calls: none
ATMPRN calls:
       INDXBK         IOERR         PRALT         RELHUM        SETBCK
INDXBK calls:
       GBLBCK
GBLBCK calls:
       AIRTMP         RDGBL         RDSCN
AIRTMP calls: none
RDGBL calls:
        IOERR        SEAICE
SEAICE calls: none
RDSCN calls:
       CITIES        IBKCNV        IOERR
CITIES calls: none
IBKCNV calls: none
PRALT calls:
       IBNSRC
RELHUM calls:
        SATUR
SATUR calls: none
SETBCK calls:
       INTR2D        MODBCK
INTR2D calls: none
MODBCK calls: none
BCKINT calls:
       FILTER         IOERR
BCKPRN calls:
        IOERR
```

```
GETHDR calls:
        IOERR
ZROINT calls: none
CNSTNT calls:
          ADD          DADD          DDIV          DIV          DMUL          DSUB
          MUL           SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
DBINIT calls:
        IOERR
INITL calls:
        BEAUFT        BINFIL        CALEND        CIRRUS        DEFALT         DFLT2
         DFLT8        EXOATM        EXOTMP        FILOPN         FILRT        GBLBCK
        GETASP        GETATM        GETBCK        GETCLD        GETEXO        GETPOS
        GETSLR        GETVAR        GETVEC         IOERR        ISRAEL        LWCASE
        MDLATM        MIEINP         PARSE        RDLINE         SATUR        SETFLG
        STGEOM        UPCASE        USRDEF           VSA        ZROHDR
BEAUFT calls: none
BINFIL calls:
        CHKRST        CHKVER        DISEND        FLSTAT         IOERR        RDLINE
        UPCASE
CHKRST calls:
        IOERR
CHKVER calls:
        IOERR
DISEND calls:
        IOERR
FLSTAT calls:
        IOERR        UPCASE
UPCASE calls: none
RDLINE calls:
        IOERR        LCTRIM        LENSTR
LCTRIM calls: none
LENSTR calls: none
CALEND calls: none
CIRRUS calls: none
DEFALT calls:
        EXOATM        GBLBCK
EXOATM calls:
        XTERP
DFLT2 calls:
        IDAERO        MDLATM
IDAERO calls: none
MDLATM calls: none
DFLT8 calls:
        DVINCR        GETVEC        RDLINE        UPCASE
DVINCR calls: none
GETVEC calls:
        IOERR        LCTRIM        LENSTR
EXOTMP calls: none
FILOPN calls:
        IOERR        RDLINE        UPCASE
FILRT calls:
        LCTRIM
GETASP calls:
        GETVEC        IGTINT        RDLINE        UPCASE
IGTINT calls:
        IOERR
```

```
GETATM calls:
       GETVAR       IGTINT       IGTVEC       LWCASE       MRNDFL       NCHAER
       NCHATM       NCHAZE       NCHSEA       RDLINE       UPCASE
GETVAR calls:
        IOERR
IGTVEC calls:
        IOERR       LCTRIM       LENSTR
LWCASE calls: none
MRNDFL calls: none
NCHAER calls:
       LCTRIM       UPCASE
NCHATM calls:
       LCTRIM       UPCASE
NCHAZE calls:
       LCTRIM       UPCASE
NCHSEA calls:
       LCTRIM       UPCASE
GETBCK calls:
       GETVAR       GETVEC       IGTINT       RDLINE       UPCASE       USRBCK
USRBCK calls:
       GETVAR       GETVEC       IGTINT       IGTVEC        IOERR        PARSE
       RDLINE       UPCASE
PARSE calls:
       LCTRIM       LENSTR
GETCLD calls:
       GETVAR       IGTINT       RDLINE       UPCASE       USRCLD
USRCLD calls:
       GETVAR       IGTINT        IOERR        PARSE       RDLINE       UPCASE
GETEXO calls:
       GETVAR       IGTINT        PARSE       RDLINE       UPCASE
GETPOS calls:
       CALEND       CHTIME       GETVAR       IGTINT       LWCASE        MONTH
       RDLINE       UPCASE
CHTIME calls: none
MONTH calls:
       LCTRIM       UPCASE
GETSLR calls:
       GETVAR       RDLINE       SPTRIG       UPCASE
SPTRIG calls: none
ISRAEL calls: none
MIEINP calls:
       GETVAR       GETVEC       IGTINT        IOERR       LWCASE        PARSE
       RDLINE       UPCASE
SETFLG calls: none
STGEOM calls:
       GETVAR       IGTINT       LWCASE       UPCASE
USRDEF calls:
       GBLBCK       GETVAR       IGTINT        IOERR       LWCASE       MDLATM
        PARSE       RDLINE       UPCASE       XMCONV        XTERP
XMCONV calls:
        SATUR        XTERP
VSA calls: none
ZROHDR calls: none
PROMPT calls: none
RDFLTR calls:
       GETVAR        IOERR       LCTRIM       LENSTR       LWCASE        PARSE
       RDLINE       UPCASE
SUMFIL calls:
       CHTIME        IOERR       LENSTR       PUTCLD       PUTSLR
PUTCLD calls:
        IOERR
PUTSLR calls:
        IOERR       SLRCNT
SLRCNT calls: none
```

7.8.2 MRFLTR Cross-Reference List

```
ADD called by:
        CNSTNT
AIRTMP called by:
        GBLBCK
ATMINT called by:
        ATMOUT
ATMOUT called by:
        MRFLTR
ATMPRN called by:
        ATMOUT
ATMSBD called by:
        ATMPRN          BCKPRN          DFLT2           GBLBCK          INITL           SETBCK
        USRDEF
BCKINT called by:
        ATMOUT
BCKPRN called by:
        ATMOUT
BEAUFT called by:
         INITL
BINFIL called by:
         INITL
BKGDBD called by:
        ATMPRN          GETBCK          INITL           SETBCK          USRBCK
CALEND called by:
        GETPOS           INITL
CHKRST called by:
        BINFIL
CHKVER called by:
        BINFIL
CHRCBD called by:
        ATMPRN          PUTCLD          SUMFIL          USRBCK
CHTIME called by:
        GETPOS          SUMFIL
CIRRUS called by:
         INITL
CITIES called by:
         RDSCN
CLDRBD called by:
        PUTCLD          USRCLD
CNSTNT called by:
        MRFLTR
CONFIG called by:
        MRFLTR
DADD called by:
        CNSTNT
DBINIT called by:
        MRFLTR
DDIV called by:
        CNSTNT
DEFALT called by:
         INITL
DEVCBD called by:
        ATMINT          ATMOUT          ATMPRN          BCKINT          BCKPRN          DBINIT
        DEFALT           DFLT8           FILRT          FLSTAT          GBLBCK          GETASP
        GETATM          GETBCK          GETCLD          GETEXO          GETPOS          GETSLR
         INITL          MIEINP          MRFLTR          PUTCLD          PUTSLR          RDFLTR
         RDGBL           RDSCN          SUMFIL          USRBCK          USRCLD
DFLT2 called by:
         INITL
DFLT8 called by:
         INITL
```

```
DISEND called by:
       BINFIL
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
DVINCR called by:
        DFLT8
ECOSBD called by:
       IBKCNV
EXMLBD called by:
       USRDEF
EXOATM called by:
       DEFALT        INITL
EXOTMP called by:
        INITL
FILOPN called by:
        INITL
FILRT called by:
        INITL
FILTER called by:
       ATMINT        BCKINT
FLSTAT called by:
       BINFIL
GBLBCK called by:
       DEFALT        INDXBK        INITL        USRDEF
GERROR called by:
        IOERR
GETASP called by:
        INITL
GETATM called by:
        INITL
GETBCK called by:
        INITL
GETCLD called by:
        INITL
GETEXO called by:
        INITL
GETHDR called by:
       ATMOUT        MRFLTR
GETPOS called by:
        INITL
GETSLR called by:
        INITL
GETVAR called by:
       GETATM        GETBCK        GETCLD        GETEXO        GETPOS        GETSLR
        INITL        MIEINP        RDFLTR        STGEOM        USRBCK        USRCLD
       USRDEF
GETVEC called by:
        DFLT8        GETASP        GETBCK         INITL        MIEINP        USRBCK
IBKCNV called by:
        RDSCN
IBNSRC called by:
        PRALT         XTERP
IDAERO called by:
        DFLT2
IGTINT called by:
       GETASP        GETATM        GETBCK        GETCLD        GETEXO        GETPOS
       MIEINP        STGEOM        USRBCK        USRCLD        USRDEF
IGTVEC called by:
       GETATM        USRBCK
INDXBK called by:
       ATMPRN
```

```
INFLBD called by:
       RDFLTR
INITL called by:
       MRFLTR
INPTBD called by:
        INITL
INTR2D called by:
       SETBCK
IOERR called by:
       ATMINT       ATMOUT       ATMPRN       BCKINT       BCKPRN       BINFIL
       CHKRST       CHKVER       DBINIT       DISEND       FILOPN       FLSTAT
       GETHDR       GETVAR       GETVEC       IGTINT       IGTVEC        INITL
       MIEINP       MRFLTR       PUTCLD       PUTSLR       RDFLTR        RDGBL
       RDLINE        RDSCN       SUMFIL       USRBCK       USRCLD       USRDEF
ISRAEL called by:
        INITL
LCTRIM called by:
        FILRT       GETVEC       IGTVEC        MONTH       NCHAER       NCHATM
       NCHAZE       NCHSEA        PARSE       RDFLTR       RDLINE
LENSTR called by:
       GETVEC       IGTVEC        PARSE       RDFLTR       RDLINE       SUMFIL
LWCASE called by:
       GETATM       GETPOS        INITL       MIEINP       RDFLTR       STGEOM
       USRDEF
MDLATM called by:
        DFLT2        INITL       USRDEF
MIEINP called by:
        INITL
MODBCK called by:
       SETBCK
MOLPBD called by:
       XMCONV
MONTH called by:
       GETPOS
MRFLTR not called
MRNDFL called by:
       GETATM
MUL called by:
       CNSTNT
NCHAER called by:
       GETATM
NCHATM called by:
       GETATM
NCHAZE called by:
       GETATM
NCHSEA called by:
       GETATM
PARSE called by:
       GETEXO        INITL       MIEINP       RDFLTR       USRBCK       USRCLD
       USRDEF
PRALT called by:
       ATMPRN
PROMPT called by:
       MRFLTR
PUTCLD called by:
       SUMFIL
PUTSLR called by:
       SUMFIL
RDFLTR called by:
       MRFLTR
RDGBL called by:
       GBLBCK
```

```
RDLINE called by:
       BINFIL          DFLT8          FILOPN          GETASP          GETATM          GETBCK
       GETCLD         GETEXO          GETPOS          GETSLR           INITL          MIEINP
       RDFLTR         USRBCK          USRCLD          USRDEF
RDSCN called by:
       GBLBCK
RELHUM called by:
       ATMPRN
SATUR called by:
        INITL         RELHUM          XMCONV
SCENBD called by:
       ATMPRN         SETBCK          USRBCK
SEAICE called by:
        RDGBL
SETBCK called by:
       ATMPRN
SETFLG called by:
        INITL         MRFLTR
SICEBD called by:
       SEAICE
SLR1BD called by:
       SLRCNT
SLRCNT called by:
       PUTSLR
SPTRIG called by:
       GETSLR
STGEOM called by:
        INITL
STMLBD called by:
       USRDEF
SUB called by:
       CNSTNT
SUMFIL called by:
       MRFLTR
UPCASE called by:
       BINFIL          DFLT8          FILOPN          FLSTAT          GETASP          GETATM
       GETBCK         GETCLD          GETEXO          GETPOS          GETSLR           INITL
       MIEINP          MONTH          NCHAER          NCHATM          NCHAZE         NCHSEA
       RDFLTR         STGEOM          USRBCK          USRCLD          USRDEF
UPPRBD called by:
       EXOATM
USRBCK called by:
       GETBCK
USRCLD called by:
       GETCLD
USRDEF called by:
        INITL
VSA called by:
        INITL
XMCONV called by:
       USRDEF
XTERP called by:
       EXOATM         FILTER          USRDEF          XMCONV
ZROHDR called by:
        INITL
ZROINT called by:
       ATMOUT
```

7.8.3 MRFLTR Pre-Requisite Order List

```
       MRFLTR         SUMFIL          PUTSLR          SLRCNT          PUTCLD          RDFLTR
       PROMPT          INITL          ZROHDR             VSA          USRDEF          XMCONV
       STGEOM         SETFLG          MIEINP          ISRAEL          GETSLR          SPTRIG
       GETPOS          MONTH          CHTIME          CALEND          GETEXO          GETCLD
```

```
USRCLD      GETBCK      USRBCK       PARSE       GETATM      NCHSEA
NCHAZE      NCHATM      NCHAER      MRNDFL       LWCASE      IGTVEC
GETVAR      GETASP      IGTINT       FILRT       FILOPN      EXOTMP
 DFLT8      GETVEC      DVINCR       DFLT2       MDLATM      IDAERO
DEFALT      EXOATM      CIRRUS      BINFIL       RDLINE      LENSTR
LCTRIM      FLSTAT      UPCASE      DISEND       CHKVER      CHKRST
BEAUFT      DBINIT      CONFIG      CNSTNT          SUB         MUL
  DSUB        DMUL         DIV        DDIV        DADD         ADD
ATMOUT      ZROINT      GETHDR      BCKPRN      BCKINT      ATMPRN
SETBCK      MODBCK      INTR2D      RELHUM       SATUR       PRALT
INDXBK      GBLBCK       RDSCN      IBKCNV      CITIES       RDGBL
SEAICE      AIRTMP      ATMINT       IOERR      GERROR      FILTER
 XTERP      IBNSRC
```

7.8.4 MRFLTR Common Block Cross-Reference List

```
Common Block BCKDAT used in:
       ATMOUT      BCKINT      BCKPRN      MRFLTR      ZROINT
Common Block DEVICE used in:
       ATMINT      ATMOUT      ATMPRN      BCKINT      BCKPRN      DBINIT
       DEFALT      DEVCBD       DFLT8      FLSTAT      GETASP      GETATM
       GETBCK      GETCLD      GETPOS      GETSLR       INITL      MIEINP
       MRFLTR      PUTCLD      PUTSLR      RDFLTR       RDGBL       RDSCN
       SUMFIL      USRBCK      USRCLD
Common Block FLAGS used in:
       ATMPRN      BCKPRN      BINFIL       INITL      ISRAEL      MRFLTR
       PUTSLR      SETFLG      SUMFIL
Common Block HEADER used in:
       ATMOUT      ATMPRN      BCKPRN      DEFALT      GETASP      GETATM
       GETBCK      GETCLD      GETHDR       INITL      MRFLTR      PUTCLD
       PUTSLR      SETBCK      SUMFIL      USRDEF      ZROHDR
Common Block INITAL used in:
        INITL      MRFLTR
Common Block CONSTN used in:
       AIRTMP      ATMOUT      ATMPRN      BCKPRN      CNSTNT      DBINIT
        DFLT2       DFLT8      EXOTMP      FILTER      GETSLR       INITL
       MODBCK       SATUR      SPTRIG      STGEOM      USRDEF       XTERP
Common Block INTSTO used in:
       ATMINT      ATMPRN      ZROINT
Common Block ATMDAT used in:
       ATMPRN      ATMSBD      BCKPRN       DFLT2       INITL      SETBCK
       USRDEF
Common Block BACKGD used in:
       ATMPRN      BKGDBD      GETBCK       INITL      SETBCK      USRBCK
Common Block CHRCNM used in:
       ATMPRN      CHRCBD      PUTCLD      SUMFIL      USRBCK
Common Block OUTPUT used in:
       ATMPRN      BCKPRN       INITL
Common Block SCENES used in:
       ATMPRN      SCENBD      SETBCK      USRBCK
Common Block RSTART used in:
       BINFIL
Common Block ANTECD used in:
       DEFALT       INITL
Common Block USERDF used in:
       DEFALT      GETASP      USRDEF
Common Block MOLECP used in:
       DBINIT       DFLT8      DVINCR      SUMFIL      USRDEF
Common Block UPRATM used in:
       EXOATM      UPPRBD
Common Block FLTRDT used in:
       FILTER      RDFLTR
Common Block MACHIN used in:
       DEVCBD      FLSTAT
```

```
Common Block CLDRN used in:
       CLDRBD       GETCLD       PUTCLD       USRCLD
Common Block ECOCNV used in:
       ECOSBD       IBKCNV
Common Block INPTDT used in:
        INITL       INPTBD
Common Block VSADTA used in:
        INITL          VSA
Common Block MATERL used in:
       MIEINP
Common Block INFLTR used in:
       INFLBD       RDFLTR
Common Block SICEDT used in:
       SEAICE       SICEBD
Common Block SOLIR1 used in:
       SLR1BD       SLRCNT
Common Block DEVCNM used in:
       DBINIT       DEVCBD        FILRT        RDGBL        RDSCN        SUMFIL
Common Block USERNM used in:
       SUMFIL       USRDEF
Common Block CLDUSR used in:
       USRCLD
Common Block EXTMOL used in:
       EXMLBD       USRDEF
Common Block STDMOL used in:
       STMLBD       USRDEF
Common Block MOLDAT used in:
       MOLPBD       XMCONV
Common Block ECOSYS used in:
       ECOSBD
Common Block INPNDX used in:
       INPTBD
Common Block MOLCON used in:
       MOLPBD
```

7.9 PLTGEN

7.9.1 PLTGEN Subprogram References

```
PLTGEN calls:
       CLSGKS       CONFIG       GETHDR       IOERR        LCTRIM       OPNGKS
       PLTDRV       PROMPT       UPCASE
CLSGKS calls: none
CONFIG calls: none
GETHDR calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
LCTRIM calls: none
OPNGKS calls: none
PLTDRV calls:
       AGSETC       AGSETF       AGSETI       APPEND       EZMXY        IOERR
       PROMPT       RDMSRT       UPCASE
AGSETC calls: none
AGSETF calls: none
AGSETI calls: none
APPEND calls:
       LENSTR
LENSTR calls: none
EZMXY calls: none
PROMPT calls: none
```

```
RDMSRT calls:
        IOERR       SLITFN
SLITFN calls: none
UPCASE calls: none
```

7.9.2 PLTGEN Cross-Reference List

```
AGSETC called by:
       PLTDRV
AGSETF called by:
       PLTDRV
AGSETI called by:
       PLTDRV
AGUTOL called by:
       PLTDRV       PLTGEN
APPEND called by:
       PLTDRV
CHRCBD called by:
       PLTDRV
CLSGKS called by:
       PLTGEN
CONFIG called by:
       PLTGEN
EZMXY called by:
       PLTDRV
GERROR called by:
        IOERR
GETHDR called by:
       PLTGEN
IOERR called by:
       GETHDR       PLTDRV       PLTGEN       RDMSRT
LCTRIM called by:
       PLTGEN
LENSTR called by:
       APPEND
OPNGKS called by:
       PLTGEN
PLTBD called by:
       PLTDRV       RDMSRT
PLTDRV called by:
       PLTGEN
PLTGEN not called
PROMPT called by:
       PLTDRV       PLTGEN
RDMSRT called by:
       PLTDRV
SLITFN called by:
       RDMSRT
UPCASE called by:
       PLTDRV       PLTGEN
```

7.9.3 PLTGEN Pre-Requisite Order List

```
PLTGEN       PLTDRV       UPCASE       RDMSRT       SLITFN       PROMPT
 EZMXY       APPEND       LENSTR       AGSETI       AGSETF       AGSETC
OPNGKS       LCTRIM       GETHDR        IOERR       GERROR       CONFIG
CLSGKS
```

7.9.4 PLTGEN Common Block Cross-Reference List

```
Common Block HEADER used in:
       GETHDR       PLTDRV       PLTGEN       RDMSRT
```

```
Common Block CHRCNM used in:
       CHRCBD       PLTDRV
Common Block CHRPRM used in:
        PLTBD       PLTDRV
Common Block PLTPRM used in:
        PLTBD       PLTDRV       RDMSRT
Common Block RMODAT used in:
       PLTDRV       RDMSRT
```

7.10 SCNGEN

7.10.1 SCNGEN Subprogram References

```
SCNGEN calls:
       CNSTNT        COEFF       CONFIG         FM2D       GETVAR       IGTINT
        IOERR       LWCASE        PARSE       PROMPT       RDLINE        SCALE
        TDFFT       TILEIT          UNI       UPCASE        XTERP
CNSTNT calls:
          ADD         DADD         DDIV          DIV         DMUL         DSUB
          MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
COEFF calls:
         GAUS
GAUS calls:
        RUNIF
RUNIF calls:
          UNI
UNI calls: none
CONFIG calls: none
FM2D calls:
         GAUS
GETVAR calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
IGTINT calls:
        IOERR
LWCASE calls: none
PARSE calls:
       LCTRIM       LENSTR
LCTRIM calls: none
LENSTR calls: none
PROMPT calls: none
RDLINE calls:
        IOERR       LCTRIM       LENSTR
SCALE calls:
         CORF
CORF calls:
        GAMMA          KNU
GAMMA calls: none
KNU calls:
        GAMMA
TDFFT calls:
        FOUR1
FOUR1 calls: none
```

```
TILEIT calls: none
UPCASE calls: none
XTERP calls:
       IBNSRC
IBNSRC calls: none
```

7.10.2 SCNGEN Cross-Reference List

```
ADD called by:
       CNSTNT
CNSTNT called by:
       SCNGEN
COEFF called by:
       SCNGEN
CONFIG called by:
       SCNGEN
CORF called by:
        SCALE
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
FM2D called by:
       SCNGEN
FOUR1 called by:
        TDFFT
GAMMA called by:
         CORF          KNU
GAUS called by:
         COEFF         FM2D
GERROR called by:
         IOERR
GETVAR called by:
       SCNGEN
IBNSRC called by:
         XTERP
IGTINT called by:
       SCNGEN
IOERR called by:
       GETVAR        IGTINT        RDLINE        SCNGEN
KNU called by:
          CORF
LCTRIM called by:
         PARSE       RDLINE
LENSTR called by:
         PARSE       RDLINE
LWCASE called by:
       SCNGEN
MUL called by:
       CNSTNT
PARSE called by:
       SCNGEN
PROMPT called by:
       SCNGEN
RDLINE called by:
       SCNGEN
RUNIF called by:
          GAUS
```

```
SCALE called by:
       SCNGEN
SCNGEN not called
SUB called by:
       CNSTNT
TDFFT called by:
       SCNGEN
TILEIT called by:
       SCNGEN
UNI called by:
        RUNIF       SCNGEN
UPCASE called by:
       SCNGEN
XTERP called by:
       SCNGEN
```

7.10.3 SCNGEN Pre-Requisite Order List

```
       SCNGEN        XTERP       IBNSRC       UPCASE       TILEIT        TDFFT
        FOUR1        SCALE         CORF          KNU        GAMMA       RDLINE
       PROMPT        PARSE       LENSTR       LCTRIM       LWCASE       IGTINT
       GETVAR        IOERR       GERROR         FM2D       CONFIG        COEFF
         GAUS        RUNIF          UNI       CNSTNT          SUB          MUL
         DSUB         DMUL          DIV         DDIV         DADD          ADD
```

7.10.4 SCNGEN Common Block Cross-Reference List

```
Common Block CONSTN used in:
       CNSTNT        COEFF        FOUR1          KNU       SCNGEN        XTERP
Common Block PIXEL used in:
       SCNGEN
```

7.11 TERTEM

7.11.1 TERTEM Subprogram References

```
TERTEM calls:
       AECALC       CNSTNT       CONFIG        FILRT       GETHDR       GETVAR
       GETVEC       HTBLNC       IGTINT       INTR2D        IOERR       LWCASE
        PARSE       PROFAC       PROMPT       RDLINE       RDUSRM        SATUR
       SEATMP       SPCLYR       UPCASE        XTERP
AECALC calls:
       PLANCK
PLANCK calls: none
CNSTNT calls:
          ADD         DADD         DDIV          DIV         DMUL         DSUB
          MUL          SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
CONFIG calls: none
FILRT calls:
       LCTRIM
LCTRIM calls: none
GETHDR calls:
        IOERR
```

```
IOERR calls:
       GERROR
GERROR calls: none
GETVAR calls:
        IOERR
GETVEC calls:
        IOERR        LCTRIM        LENSTR
LENSTR calls: none
HTBLNC calls:
       SRFLUX
SRFLUX calls:
       EVAPOR         SATUR
EVAPOR calls:
        XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
SATUR calls: none
IGTINT calls:
        IOERR
INTR2D calls: none
LWCASE calls: none
PARSE calls:
       LCTRIM        LENSTR
PROFAC calls:
       IBNSRC
PROMPT calls: none
RDLINE calls:
        IOERR        LCTRIM        LENSTR
RDUSRM calls:
       GETVAR        NCHTER        RDLINE        UPCASE
NCHTER calls:
       LCTRIM        UPCASE
UPCASE calls: none
SEATMP calls: none
SPCLYR calls:
       DENAIR        DENWTR        SPHAIR        SPHICE        SPHWTR        THCAIR
       THCICE        THCSNW        THCWTR
DENAIR calls:
       VIRIAL
VIRIAL calls:
        XTERP
DENWTR calls: none
SPHAIR calls: none
SPHICE calls:
        XTERP
SPHWTR calls:
        XTERP
THCAIR calls: none
THCICE calls:
        XTERP
THCSNW calls: none
THCWTR calls:
        XTERP
```

7.11.2 TERTEM Cross-Reference List

```
ADD called by:
       CNSTNT
AECALC called by:
       TERTEM
ATMSBD called by:
       TERTEM
```

```
BKGDBD called by:
       RDUSRM       SPCLYR       TERTEM
CHRCBD called by:
       TERTEM
CNSTNT called by:
       TERTEM
CONFIG called by:
       TERTEM
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DENAIR called by:
       SPCLYR
DENWTR called by:
       SPCLYR
DEVCBD called by:
        FILRT       TERTEM
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
EVAPOR called by:
       SRFLUX
EXMLBD called by:
       TERTEM
FILRT called by:
       TERTEM
GERROR called by:
        IOERR
GETHDR called by:
       TERTEM
GETVAR called by:
       RDUSRM       TERTEM
GETVEC called by:
       TERTEM
HTBLNC called by:
       TERTEM
IBNSRC called by:
       PROFAC        XTERP
IGTINT called by:
       TERTEM
INTR2D called by:
       TERTEM
IOERR called by:
       GETHDR       GETVAR       GETVEC       IGTINT       RDLINE       TERTEM
LCTRIM called by:
        FILRT       GETVEC       NCHTER        PARSE       RDLINE
LENSTR called by:
       GETVEC        PARSE       RDLINE
LWCASE called by:
       TERTEM
MOLPBD called by:
       DENAIR
MUL called by:
       CNSTNT
NCHTER called by:
       RDUSRM
OCNTBD called by:
       SEATMP
PARSE called by:
       TERTEM
```

```
PLANCK called by:
       AECALC
PROFAC called by:
       TERTEM
PROMPT called by:
       TERTEM
RDLINE called by:
       RDUSRM          TERTEM
RDUSRM called by:
       TERTEM
SATUR called by:
       SRFLUX          TERTEM
SEATMP called by:
       TERTEM
SPCLYR called by:
       TERTEM
SPHAIR called by:
       SPCLYR
SPHICE called by:
       SPCLYR
SPHWTR called by:
       SPCLYR
SRFLUX called by:
       HTBLNC
SUB called by:
       CNSTNT
TERTEM not called
THCAIR called by:
       SPCLYR
THCICE called by:
       SPCLYR
THCSNW called by:
       SPCLYR
THCWTR called by:
       SPCLYR
UPCASE called by:
       NCHTER          RDUSRM          TERTEM
VIRIAL called by:
       DENAIR
VIRLBD called by:
       VIRIAL
XTERP called by:
       EVAPOR          SPHICE          SPHWTR          TERTEM          THCICE          THCWTR
       VIRIAL
```

7.11.3 TERTEM Pre-Requisite Order List

```
TERTEM          SPCLYR          THCWTR          THCSNW          THCICE          THCAIR
SPHWTR          SPHICE          SPHAIR          DENWTR          DENAIR          VIRIAL
SEATMP          RDUSRM          RDLINE          NCHTER          UPCASE          GETVAR
PROMPT          PROFAC           PARSE          LWCASE          INTR2D          IGTINT
HTBLNC          SRFLUX           SATUR          EVAPOR           XTERP          IBNSRC
GETVEC          LENSTR          GETHDR           IOERR          GERROR           FILRT
LCTRIM          CONFIG          CNSTNT             SUB             MUL            DSUB
  DMUL             DIV            DDIV            DADD             ADD          AECALC
PLANCK
```

7.11.4 TERTEM Common Block Cross-Reference List

```
Common Block ATMDAT used in:
       ATMSBD          TERTEM
Common Block BACKGD used in:
       BKGDBD          RDUSRM          SPCLYR          TERTEM
```

```
Common Block CHRCNM used in:
       CHRCBD        TERTEM
Common Block CONSTN used in:
       CNSTNT        HTBLNC        PLANCK        PROFAC        SATUR        SPCLYR
       TERTEM         XTERP
Common Block DEVICE used in:
       DEVCBD        TERTEM
Common Block EXTMOL used in:
       EXMLBD        TERTEM
Common Block HEADER used in:
       GETHDR        TERTEM
Common Block MOLDAT used in:
       DENAIR        MOLPBD
Common Block DEVCNM used in:
       DEVCBD         FILRT
Common Block TMPOCN used in:
       OCNTBD        SEATMP
Common Block VIRDAT used in:
       VIRIAL        VIRLBD
Common Block MACHIN used in:
       DEVCBD
Common Block MOLCON used in:
       MOLPBD
```

7.12 VISUAL

7.12.1 VISUAL Subprogram References

```
VISUAL calls:
       CNSTNT         COLOR        CONFIG         FILRT        GETHDR        HUMAN
        IOERR         NRMLZ        PROMPT        SETFLG        SUMFIL        SUMIT
CNSTNT calls:
          ADD          DADD          DDIV           DIV          DMUL         DSUB
          MUL           SUB
ADD calls: none
DADD calls: none
DDIV calls: none
DIV calls: none
DMUL calls: none
DSUB calls: none
MUL calls: none
SUB calls: none
COLOR calls: none
CONFIG calls: none
FILRT calls:
       LCTRIM
LCTRIM calls: none
GETHDR calls:
        IOERR
IOERR calls:
       GERROR
GERROR calls: none
HUMAN calls:
         XTERP
XTERP calls:
       IBNSRC
IBNSRC calls: none
NRMLZ calls: none
PROMPT calls: none
SETFLG calls: none
SUMFIL calls:
       CHTIME        IOERR        LENSTR        PUTCLD        PUTSLR
CHTIME calls: none
```

```
LENSTR calls: none
PUTCLD calls:
        IOERR
PUTSLR calls:
        IOERR           SLRCNT
SLRCNT calls: none
SUMIT calls: none
```

7.12.2 VISUAL Cross-Reference List

```
ADD called by:
       CNSTNT
CHRCBD called by:
       PUTCLD           SUMFIL
CHTIME called by:
       SUMFIL
CLDRBD called by:
       PUTCLD
CNSTNT called by:
       VISUAL
COLOR called by:
       VISUAL
CONFIG called by:
       VISUAL
DADD called by:
       CNSTNT
DDIV called by:
       CNSTNT
DEVCBD called by:
        FILRT           PUTCLD          PUTSLR          SUMFIL          VISUAL
DIV called by:
       CNSTNT
DMUL called by:
       CNSTNT
DSUB called by:
       CNSTNT
FILRT called by:
       VISUAL
GERROR called by:
        IOERR
GETHDR called by:
       VISUAL
HUMAN called by:
       VISUAL
IBNSRC called by:
        XTERP
IOERR called by:
       GETHDR           PUTCLD          PUTSLR          SUMFIL          VISUAL
LCTRIM called by:
        FILRT
LENSTR called by:
       SUMFIL
MUL called by:
       CNSTNT
NRMLZ called by:
       VISUAL
PROMPT called by:
       VISUAL
PUTCLD called by:
       SUMFIL
PUTSLR called by:
       SUMFIL
SETFLG called by:
       VISUAL
```

```
SLR1BD called by:
       SLRCNT
SLRCNT called by:
       PUTSLR
SUB called by:
       CNSTNT
SUMFIL called by:
       VISUAL
SUMIT called by:
       VISUAL
VISUAL not called
XTERP called by:
        HUMAN
```

7.12.3 VISUAL Pre-Requisite Order List

```
      VISUAL        SUMIT       SUMFIL       PUTSLR       SLRCNT       PUTCLD
      LENSTR       CHTIME       SETFLG       PROMPT        NRMLZ        HUMAN
       XTERP       IBNSRC       GETHDR        IOERR       GERROR        FILRT
      LCTRIM       CONFIG        COLOR       CNSTNT          SUB          MUL
        DSUB         DMUL          DIV         DDIV         DADD          ADD
```

7.12.4 VISUAL Common Block Cross-Reference List

```
Common Block CONSTN used in:
       CNSTNT       VISUAL        XTERP
Common Block DEVICE used in:
       DEVCBD       PUTCLD       PUTSLR       SUMFIL       VISUAL
Common Block FLAGS used in:
       PUTSLR       SETFLG       SUMFIL       VISUAL
Common Block HEADER used in:
       GETHDR       PUTCLD       PUTSLR       SUMFIL       VISUAL
Common Block MOLECP used in:
       SUMFIL       VISUAL
Common Block USERNM used in:
       SUMFIL       VISUAL
Common Block CHRCNM used in:
       CHRCBD       PUTCLD       SUMFIL
Common Block CLDRN used in:
       CLDRBD       PUTCLD
Common Block SOLIR1 used in:
       SLR1BD       SLRCNT
Common Block DEVCNM used in:
       DEVCBD        FILRT       SUMFIL
Common Block MACHIN used in:
       DEVCBD
```